EXPANSION IN THE BRITISH PHARMACEUTICAL INDUSTRY

Manufacturing Chemist

incorporating

MANUFACTURING PERFUMER

Vol. XXX No. 5 A PUBLICATION OF THE LEONARD HILL TECHNICAL GROUP MAY, 1959

Bottles that win battles

RAN INTO old Smithers the other day. Remember the fella? He's had some complaint called the bottle horrors. Almost unhinged him.
It was his Board. No, not medical. Directors. Always on at him to "Win the sales battle." Smithers wanted to throw overboard the bottle they've sold the stuff in for the last hundred years and get a new one. But the poor chap couldn't find a decent-looking design anywhere. Started seeing elephant-shaped bottles in his sleep. Going round the bend.
In a bin? No. Bunch of chappies called United Glass saved him. Their design boys came up with just the thing. Lucky they're fixed up to supply bottles by the million — he's needing them now.

United Glass have eight factories, each one of them producing bottles by the million—enough to keep all their thousands of customers fully supplied. The Glass Packaging Advisory Bureau, part of the United Glass service, will be glad to answer all your glass packaging questions. Please get in touch.

UNITED GLASS

United Glass Ltd., 8 Leicester Street, London, W.C.2. Tel: GERrard 8611. Telegrams: Glaspak, Lesquare, London.

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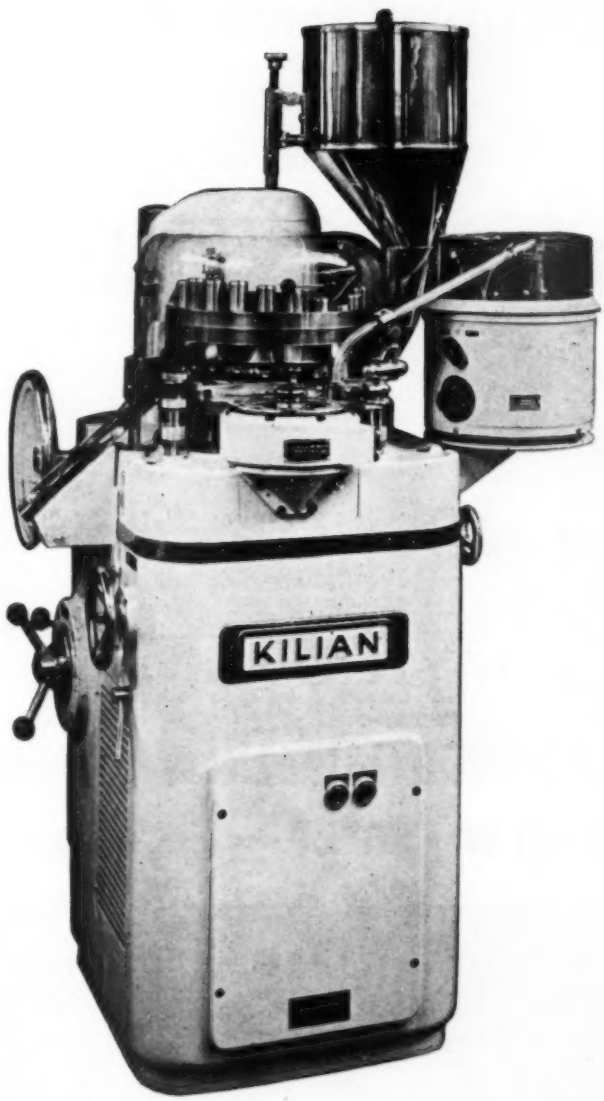
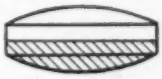
PRESCOTER MARK III



THE MACHINE
DESIGNED FOR
PRESS COATED TABLETS

TWO LAYER TABLETS
(SANDWICH—TABLET)



NORMAL TABLETS

STRIKING SIMPLICITY IN OPERATION

WITH AUTOMATIC EJECTION SYSTEM FOR INCORRECT TABLETS

KILIAN & CO. MASCHINENFABRIK COLOGNE-NIEHL WEST GERMANY

Founded 1875

Also manufacturers of all types of tablet presses, powder compact presses, powder filling machines, etc.

U.K. REPRESENTATIVES

ANGLO CONTINENTAL MACHINES LIMITED

41-2 DOVER STREET PICCADILLY LONDON W.1. *Telephone: MAYfair 4691/2*

INDEX TO ADVERTISERS

PROTECTING CHEMICALS IS A JOB FOR PALFSACKS

Here is the solution to the everlastingly tricky problem of finding the right container for Chemicals. PALFSACKS, multi-wall paper sacks, provide the complete protection that is so essential: against contamination, against leaks, against weather, against dirt and vermin. PALFSACKS are literally tailor-made for the job because they are supplied with choice of linings, Polythene, Wax, Silicone, Bitumen and others, to keep your products pure. *And* they are easy to handle and store into the bargain. For full details of the complete PALFSACK range please write to the address below.

Not just paper sacks—but

PALFSACKS

PALFSACK

WILLIAM PALFREY LTD., (Dept. M.C.),
Palfrey House, 24, City Road, London, E.C.1. Tel: MONarch 0681

STABLE EMULSIONS

The makers of the well-known anionic emulsifier

"LANETTE" WAX SX
(Regd. Trade Mark)

now recommend with confidence their new non-ionic self-emulsifying wax

"LANBRITOL" WAX N21
(Regd. Trade Mark)

Introduced just three years ago, it is now in regular bulk use by a large number of cosmetic and pharmaceutical manufacturers, who report it to be unequalled for the following purposes:

SPECIFIC USES. For o/w emulsions of all consistencies where anionics are contra-indicated, viz. :

(1) Where the cosmetic, antiseptic, therapeutic or antibiotic ingredient is **cationic** in structure.

(2) With salts of **polyvalent** metals such as aluminium, zinc, strontium and lead, e.g. deodorant creams.

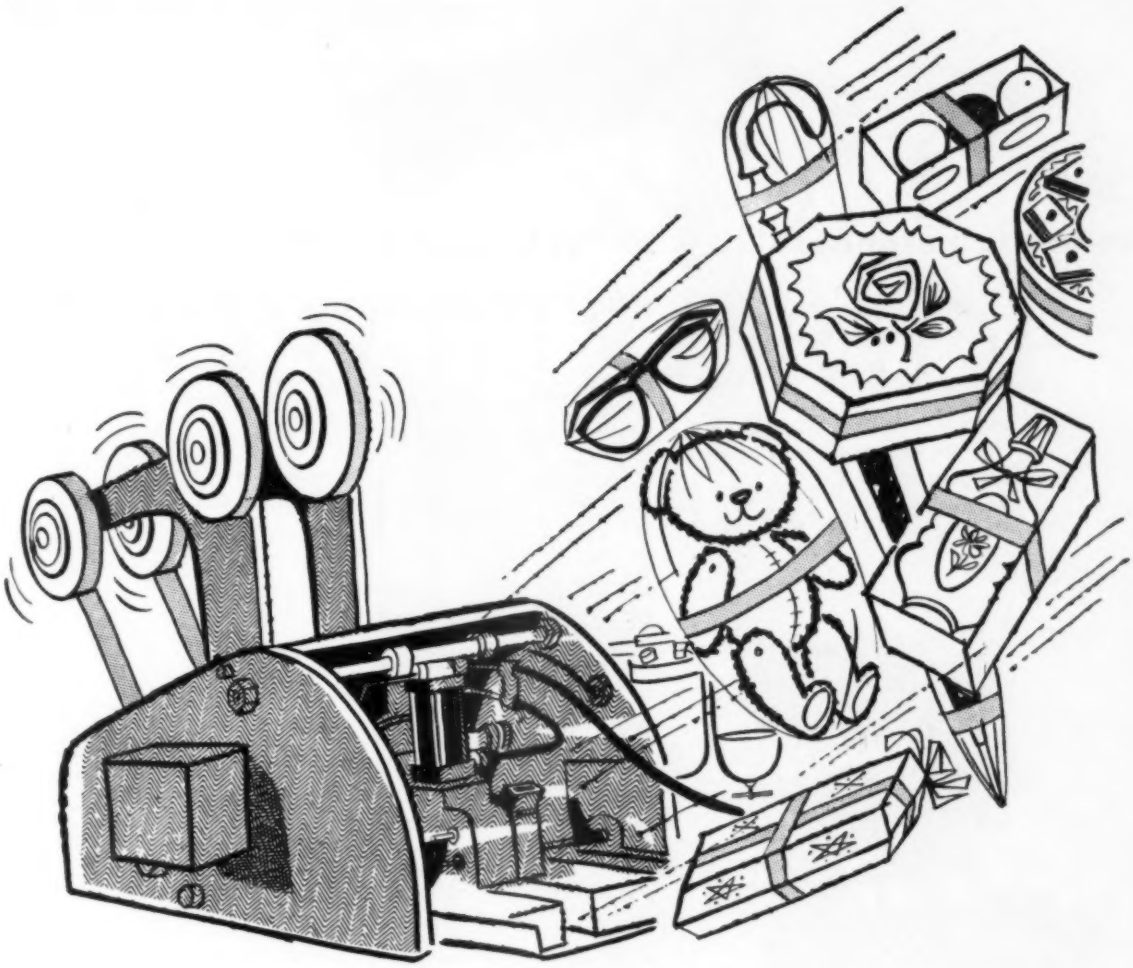
GENERAL USES. For **all thin emulsions,** e.g. from milks to pourable creams, irrespective of the ionic nature of the components
Such thin emulsions are normally difficult to make in stable form; but with "Lanbritol" Wax N21 processing is simple and the stability achieved is quite remarkable.

Write for booklet giving full details and tested illustrative formulae to the sole manufacturers:

RONSHEIM & MOORE LTD.

8, BUCKINGHAM PALACE GARDENS, LONDON, S.W.1.

Telephone: SLOane 7600 Telegrams: Gardinol Sowest London



MACHINES THAT SEAL ALMOST ANYTHING!

The Lassotape Machinery Service offers a complete range of speedy sealing machines. Manually operated dispensers, semi-automatic and fully automatic machines that can seal almost every shape, size and type of container. Lassotape sealers are not only quicker—they're *surer;* they give a consistently better seal than could possibly be achieved by hand.

If you would like to see these machines and have the advice of a package sealing expert, write, without obligation, for our travelling demonstration unit to visit you.

LASSOTAPE MACHINERY SERVICE

S&N SMITH & NEPHEW LIMITED · WELWYN GARDEN CITY · HERTS

Vessels to a standard or "specials" to order

Giusti has the answer in stainless steel

1000 gallon stainless steel reaction vessel with stainless steel spiral coil, column and condenser. (All in EN.58.J).

Standard 150 gallon hemispherical jacketed pan-type. SSP.138.B.

Our unique experience of stainless steel fabrication is wide because we specialise in diversity. For years we have made an exceptionally wide range of processing plant and equipment to order. Practically no job has been too small (and few too big) for us to produce a practical answer in good time and at a competitive price. Now Giusti service includes a standard range of storage, mixing and jacketed vessels in stainless steel. "Standard" or "Special", Giusti can meet your *needs.*

GIUSTI

Plant and Equipment Engineers to the Chemical and Food Industries.

Stainless steel horizontal storage vessel.

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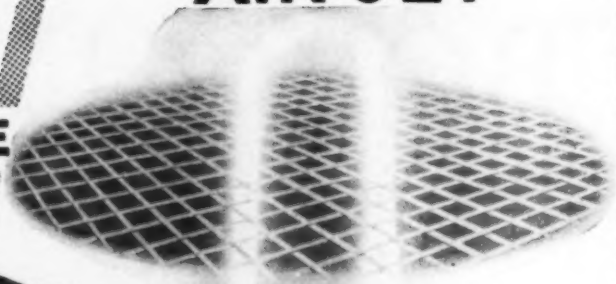
210-212 York Way, Kings Cross, London, N.7. Telephone: NORth 5021

GRAIN ANALYSIS

Quickly accurately by

AIR JET

ALPINE AIR JET SIEVE



NO WEAR OR TEAR OF SIEVES
MINIMUM TIME REQUIRED

This modern sieving apparatus utilises the new principle of aerodynamic sieve analysing developed by Alpine A.G., which gives greater accuracy in less time. A constant air flow passing through the sieve mesh prevents clogging and carries the undersize material through. There are no mechanical or disturbing effects on the material being tested, no falsification of results and no damage to sieves which may occur by other methods. Please write for further details of this unique apparatus.

Manufactured by ALPINE A.G. of AUGSBURG

Distributed by

LAVINO (LONDON) LIMITED

31-45 GRESHAM STREET, LONDON, E.C.2. **Tel.: Monarch 6137**

The Packaging Manager

is crazy about

LASSO No. 76 Vinyl Tape

The man's in love with the stuff. Talks of nothing else. Mellifluous phrases roll off his tongue . . . interminably. "Amazing pliability," he says . . . "Water-proof and moisture-vapour proof," he shouts . . . "Pressure sensitive adhesive tape with exceptionally long storage life . . . !" One can stand just *so* much!

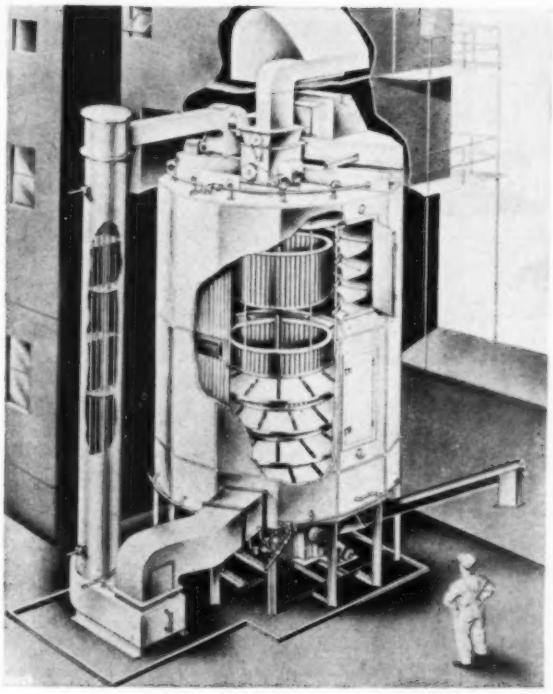
SEALING MACHINES DEMONSTRATED The Lassotape Machinery Service offers a complete range of sealing machines — from hand operated dispensers to automatic machines. If you would like to see these efficient sealers and have the advice of a package sealing expert, write, without obligation, for our travelling demonstration unit to visit you.

For further information on Lasso No. 76 Vinyl Tape and other Lassotapes for the packaging industry, write to the address below.

LASSOTAPES

FOR ALL PACKAGING AND INDUSTRIAL USES

S&N SMITH & NEPHEW LIMITED • WELWYN GARDEN CITY • HERTS



Cutaway illustration of a typical Sturtevant Wyssmont Closed Circuit Turbo-Dryer.

THE

STURTEVANT WYSSMONT TURBO-DRYER

for

FAST

EFFICIENT

ECONOMICAL

DRYING

Built for continuous uninterrupted operation

- Uniform drying
- Low operating costs
- Low maintenance costs
- Space saving
- No overheating
- No excessive fines
- No fumes or dusts
- No excessive caking

WHEN USED IN CLOSED CIRCUIT

is particularly suitable for products that are :—

- Fragile
- Obnoxious
- Oxidisable
- Heat sensitive
- Solid with a hazardous solvent which must be removed safely and recovered

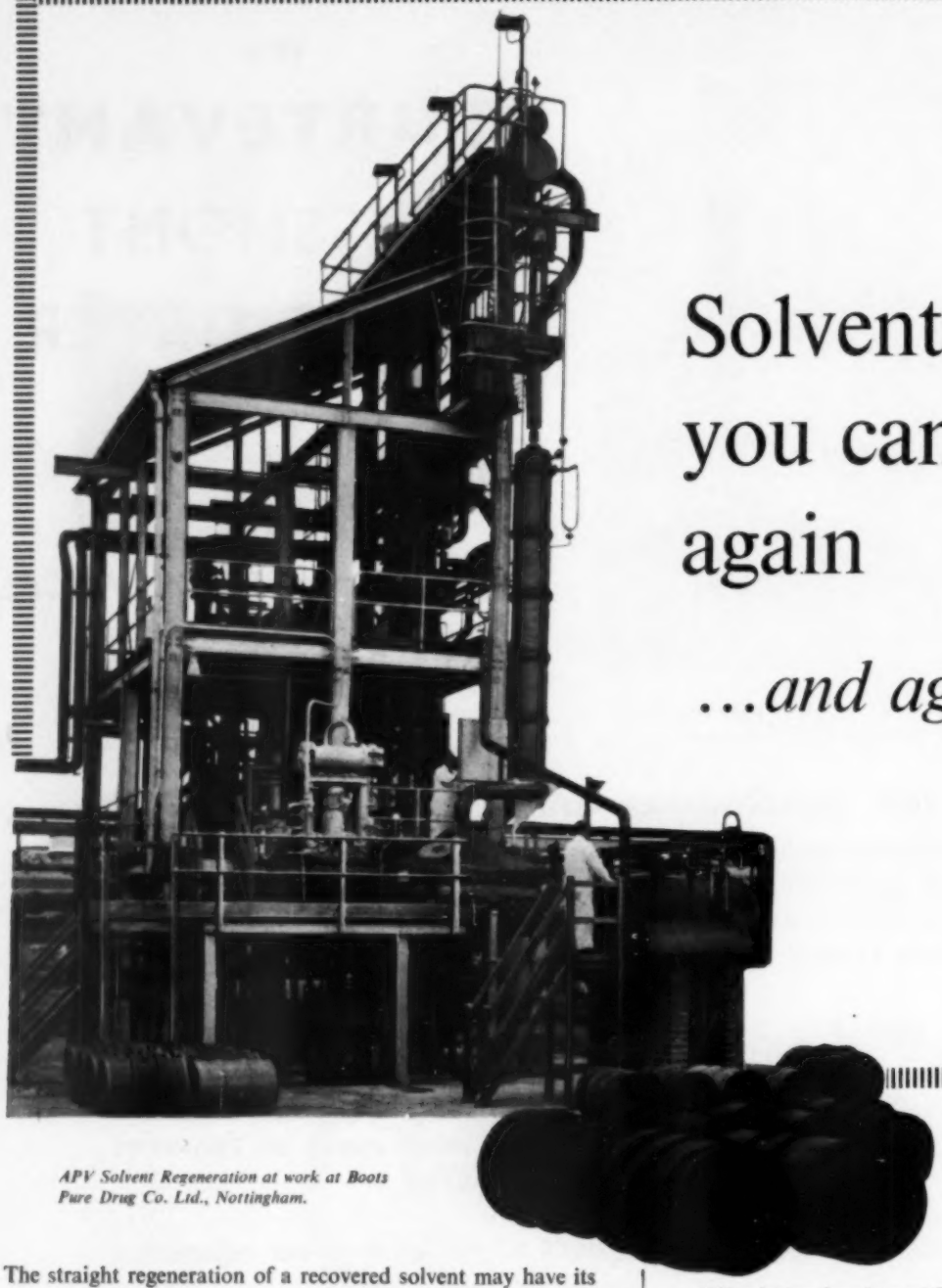
CONSIDER ALL THESE POINTS — and write to our reference Z101/V for further particulars

Sturtevant have an agreement to manufacture and sell the Wyssmont Turbo-Dryer. This dryer is used extensively in the U.S.A. and elsewhere on a wide range of high grade chemicals.

STURTEVANT ENGINEERING CO. LTD.

Southern House, Cannon Street, LONDON, E. C. 4.

AUSTRALIA : STURTEVANT ENGINEERING CO. (AUSTRALASIA) LTD. 400 SUSSEX STREET SYDNEY N.S.W.



Solvents you can use again

...*and again*

APV Solvent Regeneration at work at Boots Pure Drug Co. Ltd., Nottingham.

The straight regeneration of a recovered solvent may have its complications, as in the case of absolute alcohol, but many modern processes leave mixtures of two or more solvents, the separation of which is impossible without advanced distillation techniques. Investigation of these mixtures by APV has resulted in the evolution of many successful processes and the complete resolution of complex mixtures into their pure components.

APV techniques have been used on mixed solvents to yield:

ACETONE, CHLOROFORM, METHYL ETHYL KETONE, METHYL ISOBUTYL KETONE, ETHYL, BUTYL AND AMYL ACETATES CARBON TETRACHLORIDE, ALL THE LOWER ALCOHOLS, ETC.

APV

CHEMICAL ENGINEERING DIVISION

THE A.P.V. COMPANY LIMITED · MANOR ROYAL · CRAWLEY · SUSSEX

TELEPHONE: CRAWLEY 1360. TELEX: 8737. TELEGRAMS: ANACLASTIC CRAWLEY

THE SHAPES VARY . . . . . USES VARY TOO

Tablets have so many obvious advantages that more and more people are using them.

Tablets are so convenient—you can be certain of accuracy, uniformity, and there is no waste. Size, shape and weight vary depending on need.

Catalysts, Plastics, Desiccants, p-Dichlorobenzene blocks, Fertilisers, Pharmaceuticals, Food Products, etc. etc. Tablets for Kjeldahl Determinations and other standardised techniques.

There are hundreds of different shapes and sizes—in thousands or millions, pounds or tons.
We will gladly advise whether a satisfactory tablet can be made—and prove it.

THOMPSON & CAPPER LTD.

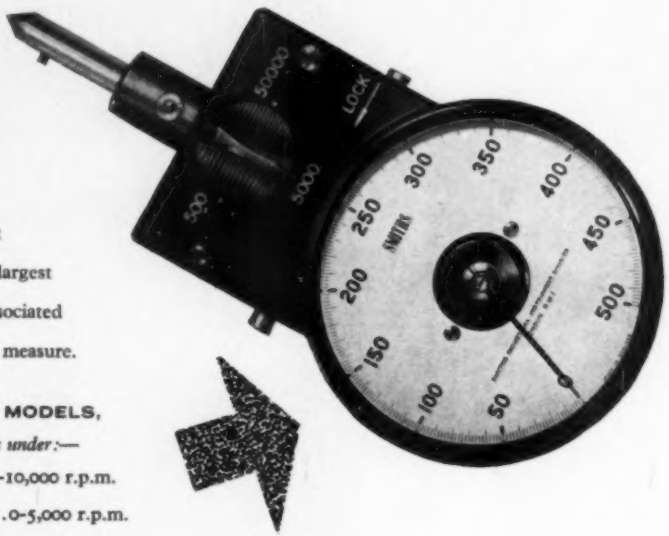
MANUFACTURING CHEMISTS

SPEKE, LIVERPOOL

Telephone: Hunts Cross 1321

SMITHS for Good Measure

By and large, Industry depends on SMITHS for good measure, both literally and metaphorically. Literally, for the robustness and long-term accuracy of their wide range of industrial instruments; metaphorically, for the service potential constituted by the unrivalled research and test facilities of an organisation which is Britain's largest manufacturer of industrial instruments and associated equipment. Such potential, is, indeed, beyond measure.

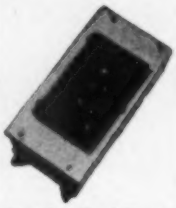


AVAILABLE IN CHOICE OF FOUR MODELS,

each complete with case and accessories, as under:—

A.T.H.4. .0-50,000 r.p.m. (illustrated)
A.T.H.6. .0-10,000 r.p.m.
A.T.H.7. .0-20,000 r.p.m.
A.T.H.10. .0-5,000 r.p.m.

Predetermined Counters for counting predetermined quantities.



Transistor Batch Counters for high speed counting of repetitive quantities.

Electric Tachometers a.c., d.c. & Three Phase.

"Petro-flex" Flexible Tubing. For the conveyance of all non-acid fluids.

Synchronous Hours Counters for indicating life of equipment in a.c. circuits.

Calibrated Relays for the control of voltage, current and speed.

Examples of

SMITHS

Good measure

HAND TACHOMETERS

Provide an accurate method of making spot checks of:-

ROTATIONAL SPEEDS—Shafts, spindles, gears, rotors and rolls.

LINEAL SPEEDS (ft/min or metres/min)—Metal strips, textiles, paper, wire, plastic film and conveyed material.

SURFACE SPEEDS (ft/min, metres/min). Cutting and grinding operations of machine tools, processing rolls, unwind rolls or wind-up rolls for extrusion and strip production.

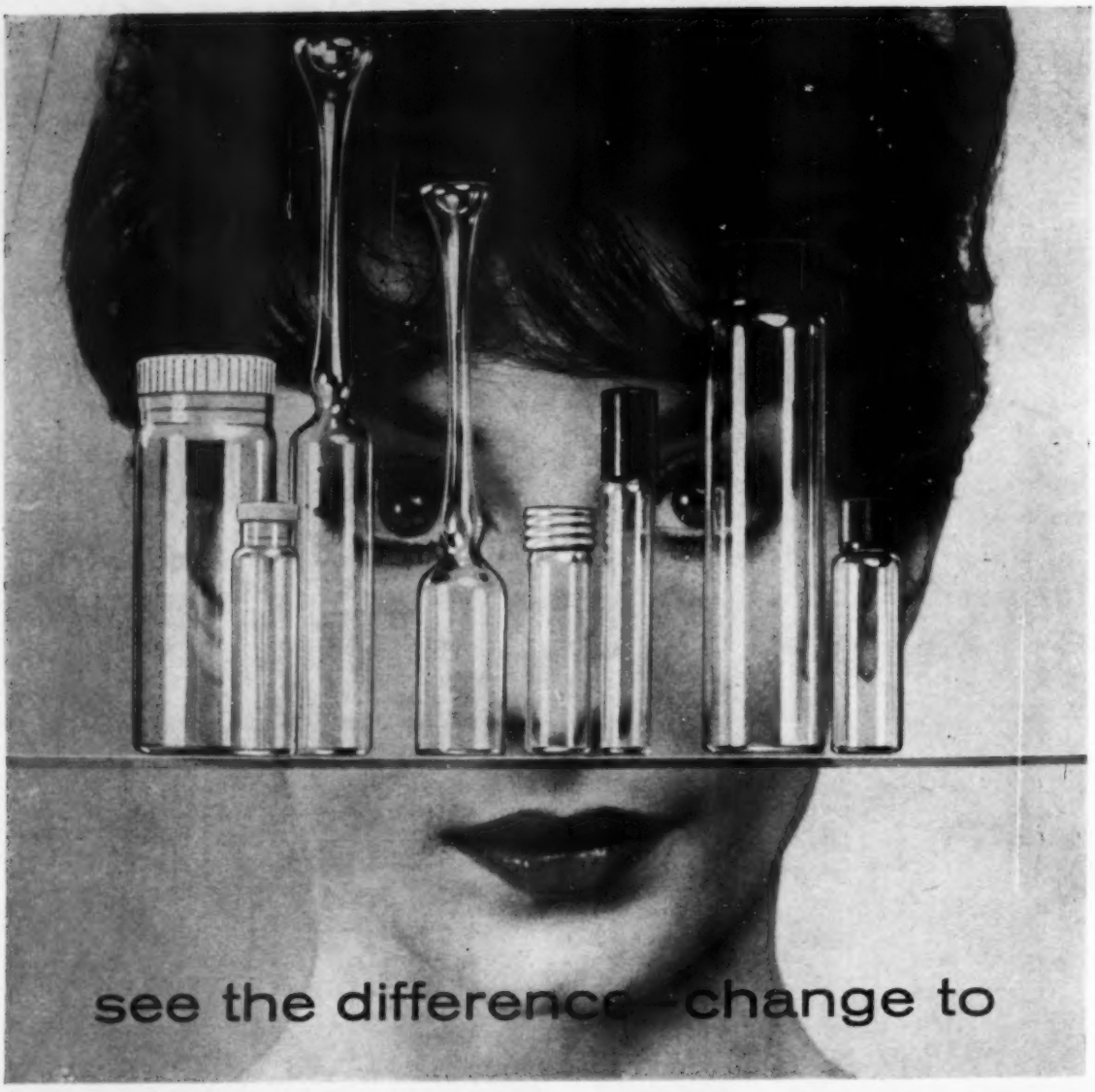
Readings can be taken in bad light or where the dial is visually obscured by using the extension shaft supplied.

Write for individual leaflets

SMITHS INDUSTRIAL INSTRUMENT DIVISION

Chronos Works, North Circular Road, London, N.W.2. Telephone: GLAdstone 1136

AP 188/370



TRIDENT
TUBULAR GLASS CONTAINERS

The noticeable thing about Trident tubular glass containers is the clarity of the glass. It has superb brilliance. That's because Trident tubes, vials and ampoules are drawn from bright, clear tubing enhancing the products on view and giving a different, more expensive look to them. We have a wide range of standard sizes, shapes and closures, at prices competitive with other kinds of containers, and we can supply almost any special size required at no great extra expense.

A further sound reason for changing to Trident tubular glass containers is the saving in packing and freight charges. They occupy a minimum of packing space and, because of their lightness in weight, freight charges are quite considerably reduced.

If you are planning a new product or giving new life to an old one, we would like to help you. Ask for our new catalogue.

Johnsen & Jorgensen Ltd.
Trident Glass Works,
Herringham Road, Charlton,
London, S.E.7.
Telephone: Greenwich 0151 (5 lines)

See our exhibit at The Packaging Centre, Poland Street, London, W.1.

5658

Ultra-fine particle size emulsions, specially developed for floor maintenance applications, are now included in the Vinamul range. Products at present available include:

	RESIN	APPROXIMATE PARTICLE SIZE	SOLIDS CONTENT	USES
VINAMUL N610:	*Modified polymethacrylate*	$\frac{1}{10}\mu$	33%	*High resin content polishes*
VINAMUL N741:	*Modified polystyrene*	$\frac{1}{100}\mu$	40%	*High resin content polishes; hardener for self-gloss wax polishes*
VINAMUL N6000:	*Alkali-soluble vinyl acetate copolymer*	1μ	55%	*Levelling agent for self-gloss polishes*

VINYL PRODUCTS LTD · CARSHALTON · SURREY · Wallington 9282

VP75

LET Clarifoil BE YOUR SHOP-WINDOW

Laminates for sachets, window-cartons for stockings and braces, transparent rigid packs for handkerchiefs, blister packs for razors . . . wherever or however crystal-clear Clarifoil is used, it builds its own shop-window round the products. Proved as a sales winner second to none. Clarifoil gives visibility, impact, dominance, and is printable in multi-colours. Pack in tough, water-resistant, flexible Clarifoil to sell, and sell quickly!

Blister Pack by Omega Plastics Ltd.
Sachets by Robinson Waxed Paper Co. Ltd.
Visual Containers by Hargill Ltd. and Visual Container Co. Ltd.
Window-cartons by J. Dring Ltd. and E. S. & A. Robinson Ltd.

✳ *The Celanese Technical Sales Service, with its unrivalled experience, is freely available to help solve your packaging problems. Write to Department* M.C.6.

Clarifoil TRADE MARK TRANSPARENT ACETATE FILM *sells on sight!*

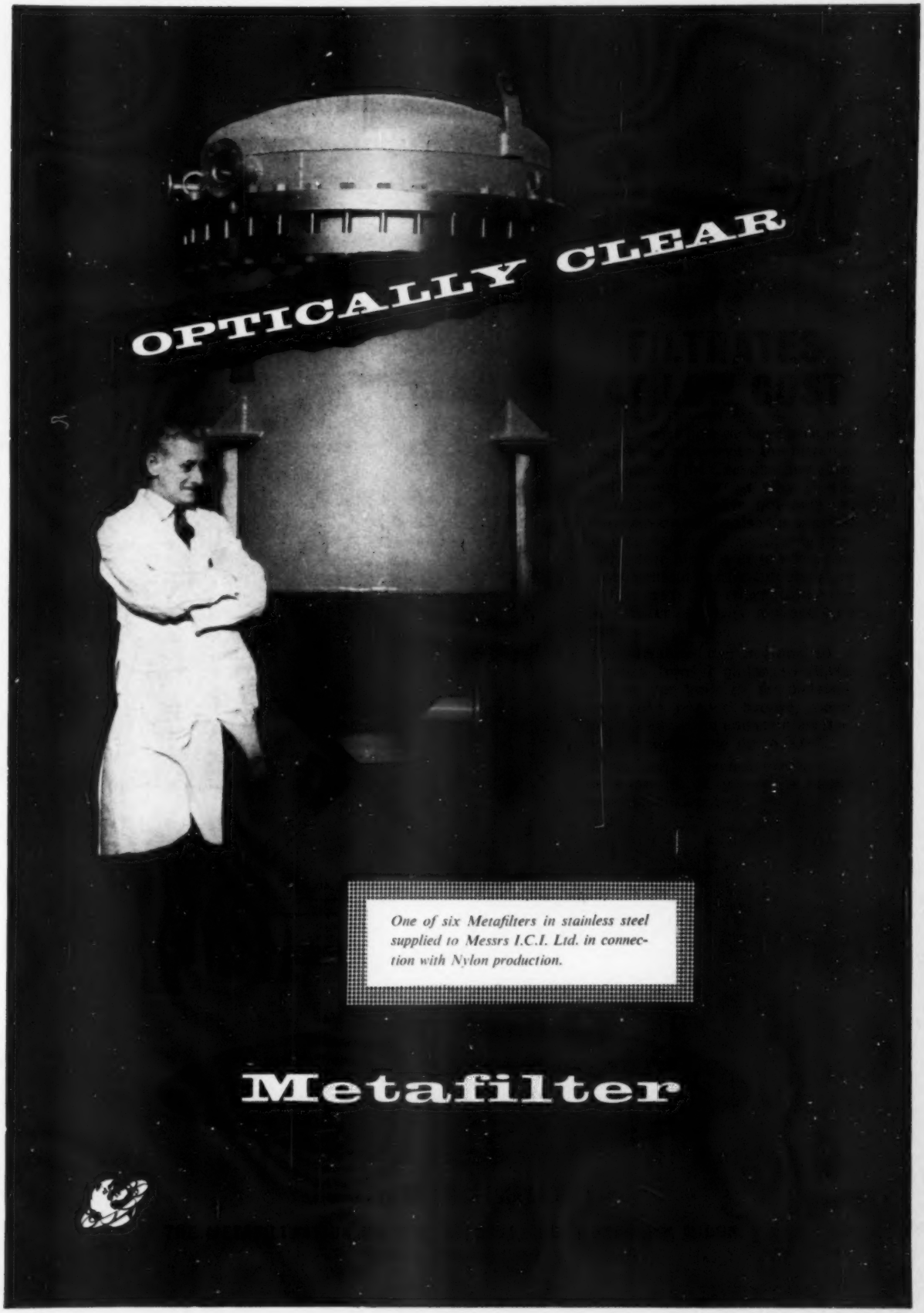
Plastics Division · British Celanese Limited · Hanover Square · London W.1 · MAYfair 8000

BPS.10.

WHAT GOES ON UNDERNEATH?

HE KNOWS. . . . that most of the iceberg and all of the fish are below the surface
WE KNOW. . . . . that the firm stable foam which Ethylans have helped to produce is a fitting cloak for the hard cleaning that goes on underneath.

LANKRO CHEMICALS LTD. ECCLES, MANCHESTER, TEL · ECCLES 5311 (6 LINES)
LONDON OFFICE: 12 WHITEHALL, LONDON, S.W.1. TEL. TRAfalgar 4081/2


OPTICALLY CLEAR
One of six Metafilters in stainless steel supplied to Messrs I.C.I. Ltd. in connection with Nylon production.
Metafilter

CITROPAL® contains the identical proportions of only those components which we found to be in terpene- and sesquiterpeneless natural lemon oil.

CITROPAL® combines the full pure odor and flavor with the stability, uniformity, availability, economy and other advantages of synthetic products.

CITROPAL® is particularly recommended:

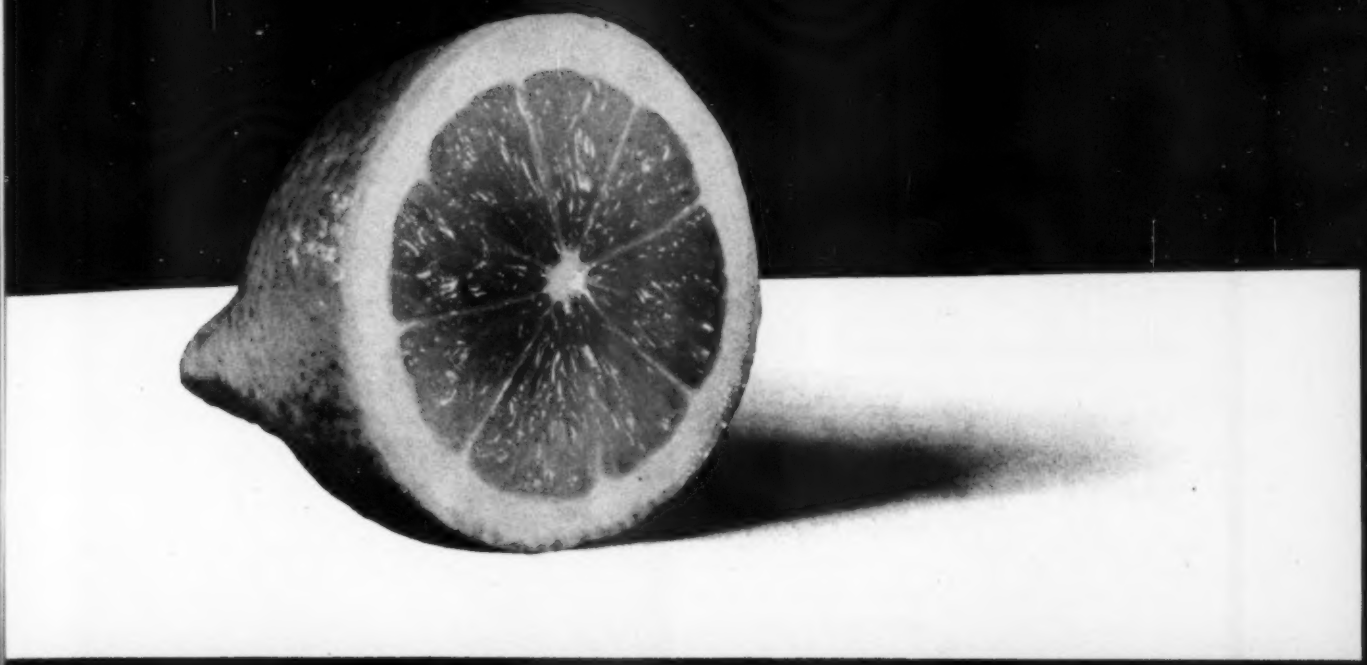
a) In compounds for Perfumes and Colognes, all Lotions, Cosmetic Products, Soaps and Detergents.
b) In the manufacture of lemon-flavors.

DRAGOCO HOLZMINDEN

Sole agents in U. K.: BRUCE STARKE & Co. Ltd.,
5, Fenchurch St., London E. C. 3.
Phone: Mansion House 3586

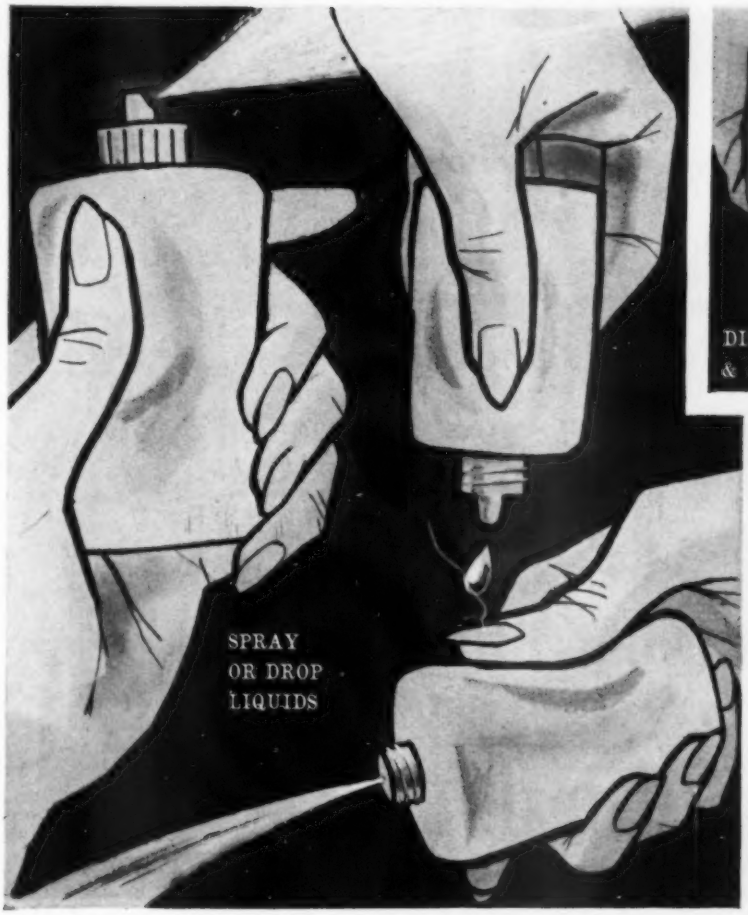
CITROPAL®

A PERFECT REPRODUCTION OF TERPENELESS LEMON OIL



Note further details and suggestions from our data sheet.

Versatile Poly-Tainers
do all these jobs—cheaply and well!



The flexibility of Poly-Tainers makes it possible to use them with a variety of simple, inexpensive fitments to spray, puff, pour or otherwise dispense many different products. Add to this the other advantages of Poly-Tainers: they are light, virtually unbreakable and can be custom-moulded to almost any shape and in many colours. There is also a wide range of stock moulds to choose from, and bottles from these moulds can be printed or embossed.

Custom-made Poly-Tainers are not expensive, especially for long runs. Alternatively stock bottles from ¼ fl. oz. to one gallon are available plain or printed, and some can even be custom embossed. Ask for the Poly-Tainer booklet NOW!

Poly-Tainer Regd

METAL BOX PLASTICS

The Plastics Group of
The Metal Box Company Ltd
37 Baker Street, London, W.1
Telephone: **Hunter 5577**

Poly-Tainers are helping to sell these, and many others—

Cosmetic and Toilet Preparations
HAIR LACQUERS AND SPRAYS
DEODORANT SPRAYS
AFTER SHAVE LOTIONS
TALCUM AND DUSTING POWDERS
LIQUID MAKE-UP
HAND CREAMS AND LOTIONS
COLOGNES
PERMANENT WAVING LOTIONS
SUN TAN OILS
CLEANSING AND OTHER SKIN LOTIONS

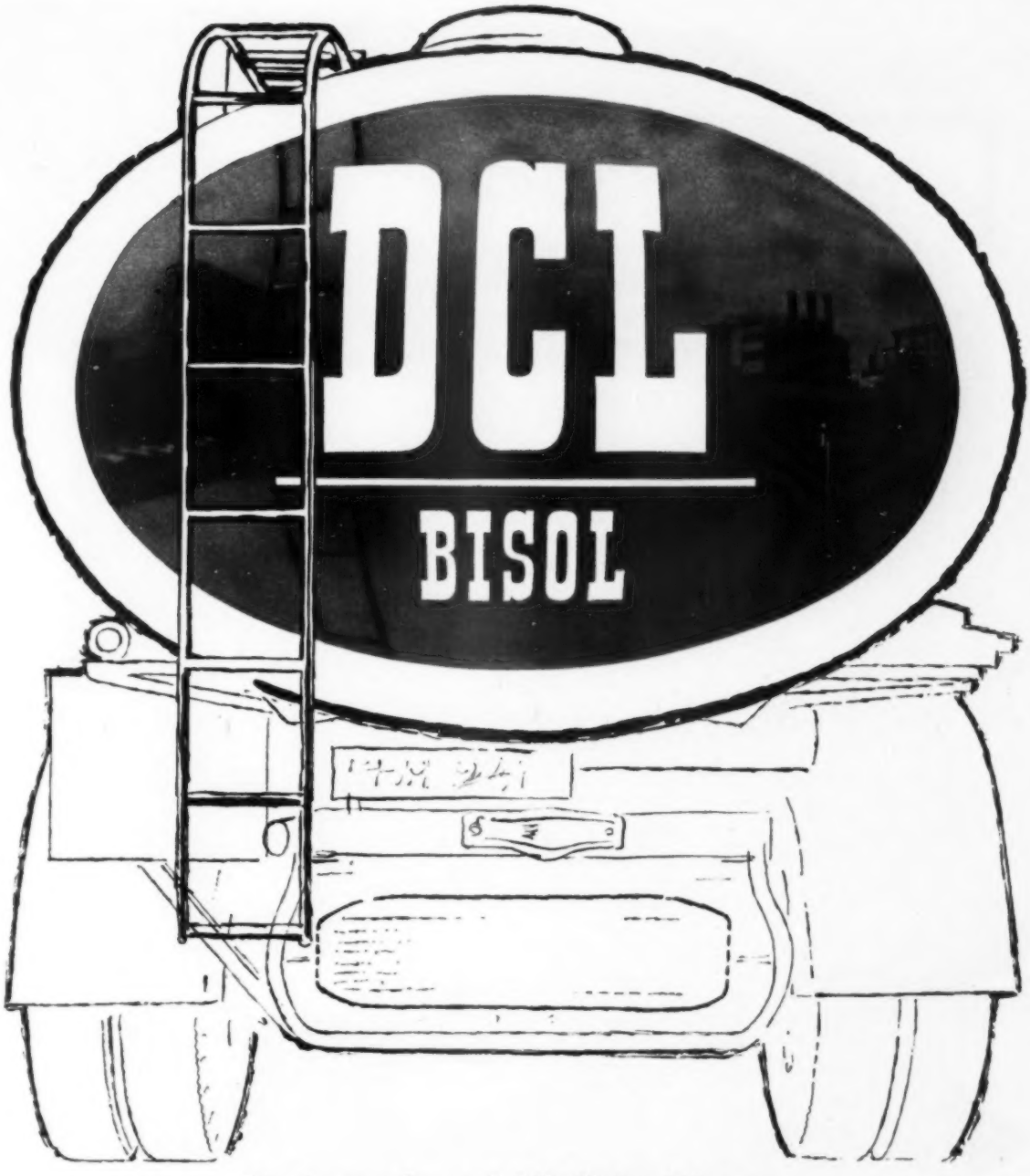
Pharmaceutical Products
NASAL SPRAYS
EYE DROPS
POWDERS

Household Products
GLUES, ADHESIVES
DISINFECTANTS
FLY SPRAYS, INSECTICIDES
RUST REMOVERS
CLEANING PRODUCTS AND DETERGENTS

Chemicals
ACIDS AND OTHER INDUSTRIAL LIQUIDS

Foodstuffs
Poly-Tainers are suitable for many foodstuffs. Please consult Metal Box about food packaging in Poly-Tainers.

55/05 VISIT US AT THE INTERNATIONAL PLASTICS EXHIBITION, OLYMPIA, FROM 17TH TO 27TH JUNE, STAND NO. 215 NATIONAL HALL.



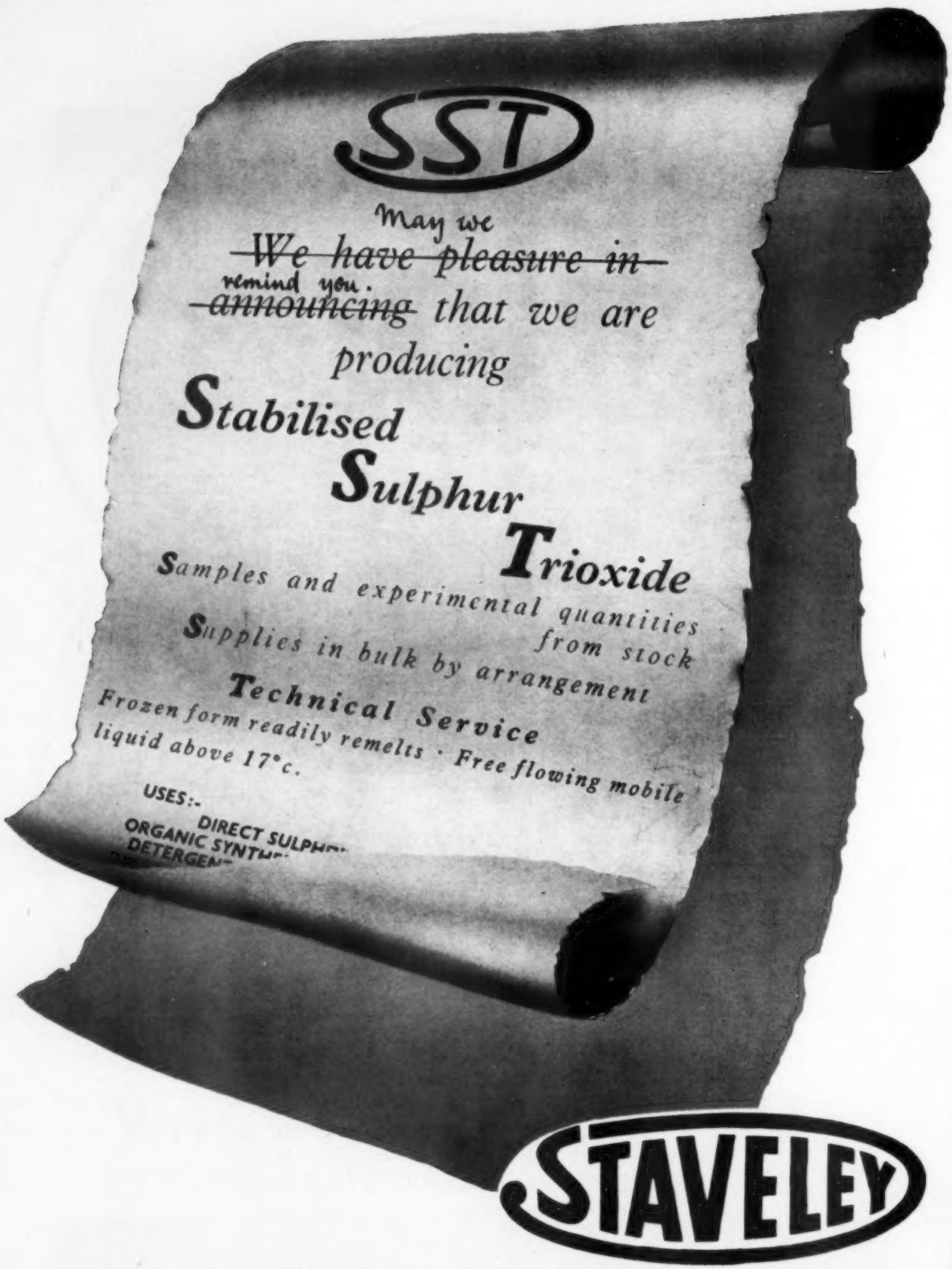
Outward and Visible Signs

The D.C.L. Tankers, seen on the roads all over Britain are the shop windows of The Distillers Company Limited—outward signs of a wide network of factories and depots covering the country, serving industry in the manufacture and prompt delivery of the Bisol range of organic chemicals in bulk.

THE DISTILLERS COMPANY LIMITED

CHEMICAL DIVISION

Bisol Sales Office. Devonshire House, Piccadilly W.1 Mayfair 8867 Cables: Chemidiv London Telex TA 196

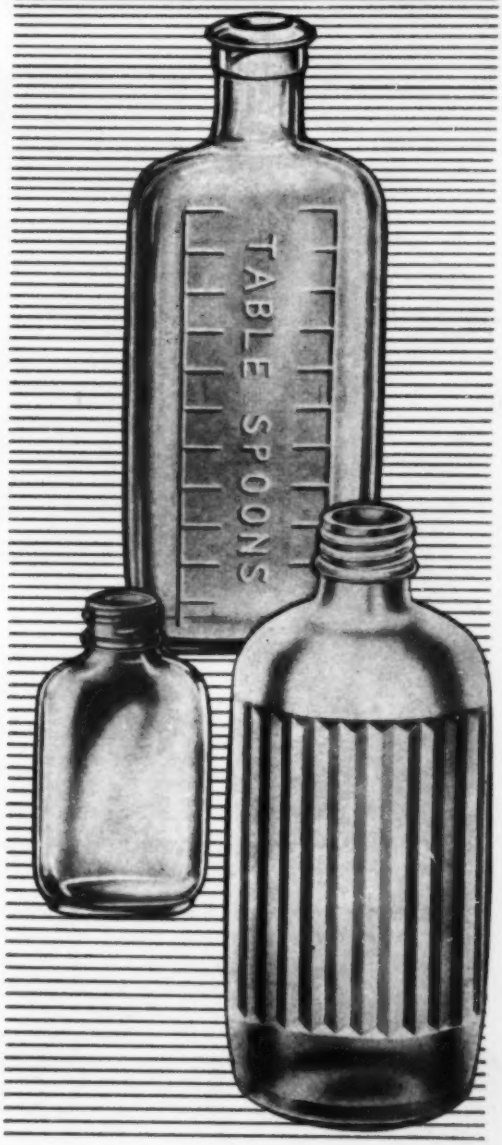


THE STAVELEY IRON & CHEMICAL CO. LTD. NR. CHESTERFIELD

QUALITY IN WHITE FLINT GLASS CONTAINERS

DISPENSING BOTTLES
1-oz. to 20-oz.
RIBBED OVALS
½-oz. to 16-oz.
PLAIN OVALS
4-oz., 8-oz. and 16-oz.
BOW-FRONT PANELS
1-oz. to 8-oz. and 16-oz.
OLIVE OIL BOTTLES
2½-oz., 5-oz. and 10-oz.
OVAL TABLET BOTTLES
Nos. 1 to 7½ sizes.
ROUND SCREW JARS
Tall and Semi-squat.
PANEL FLATS
1 oz to 4-oz.
VIALS
½-oz. to 3-oz.
RECTANGULAR TABLET BOTTLES
Nos. 1, 2, 3, 4, 5, 6 and 9 sizes

✲ **AMBER BOTTLES.** We can now offer certain types of glass containers in Amber and your enquiries are invited.



First Class in **GLASS**

NATIONAL GLASS WORKS (YORK) LTD.
FISHERGATE, YORK. Tel. YORK 23021
ALSO AT: CAROLINE HOUSE, 55-57 HIGH HOLBORN, LONDON, W.C.1. Tel. HOLBORN 2146

- *Prompt delivery from stock*
- *Packed in easily handled cartons*
- *Wholesale only*

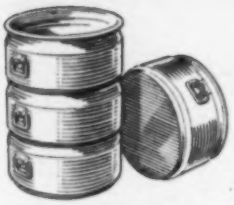
Trade N Mark

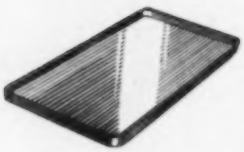
Selling Agents in Northern Ireland: Magowan, Vicars (Chemicals) Ltd., 64-66 Townsend Street, BELFAST. Tel: Belfast 29830.

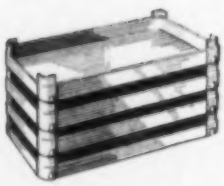
HYGIENE puts YOU on OUR metal!

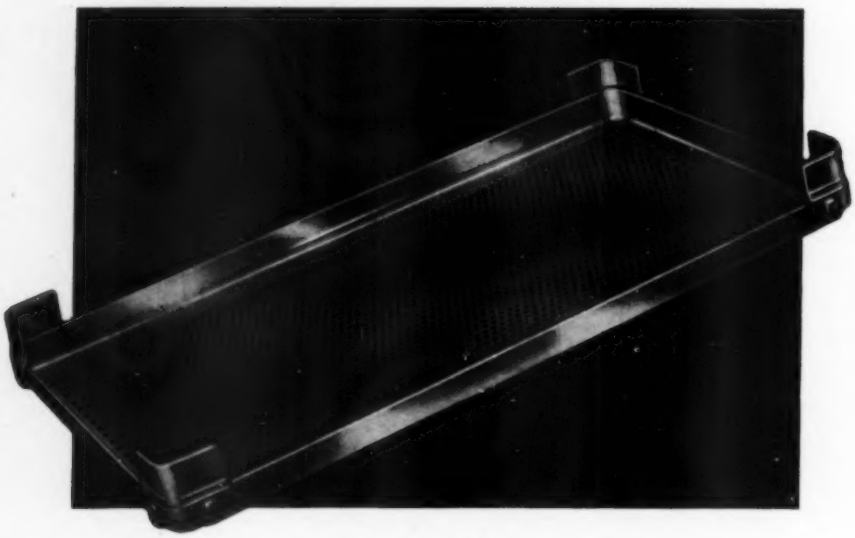
ALUMINIUM

Perforated Trays









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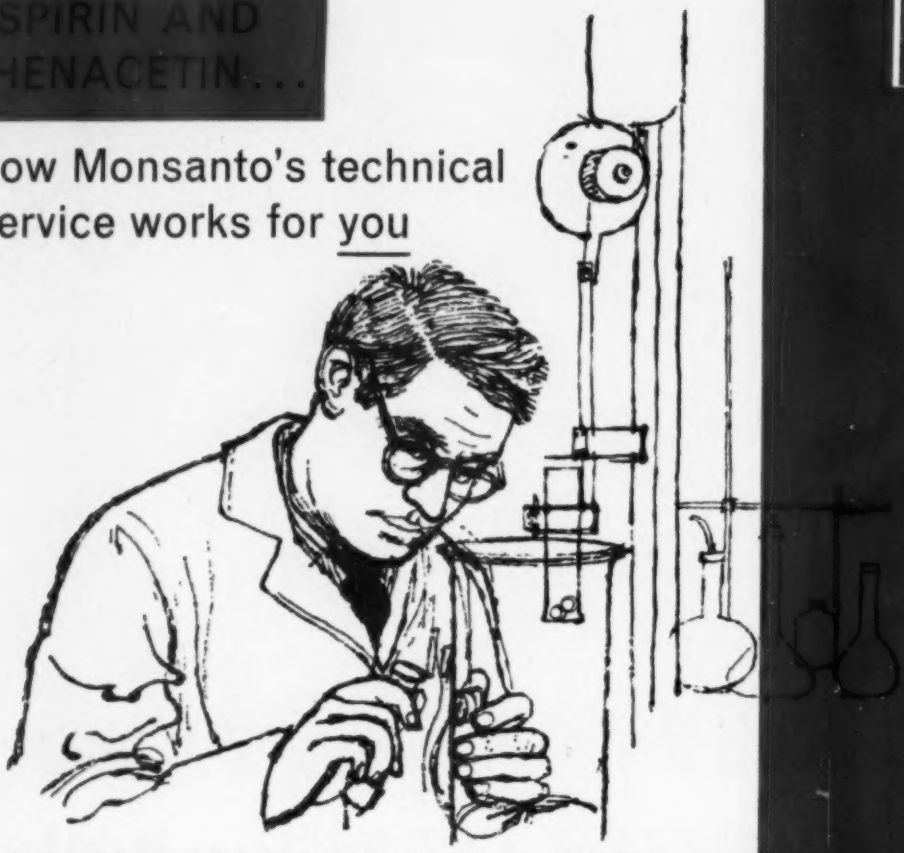

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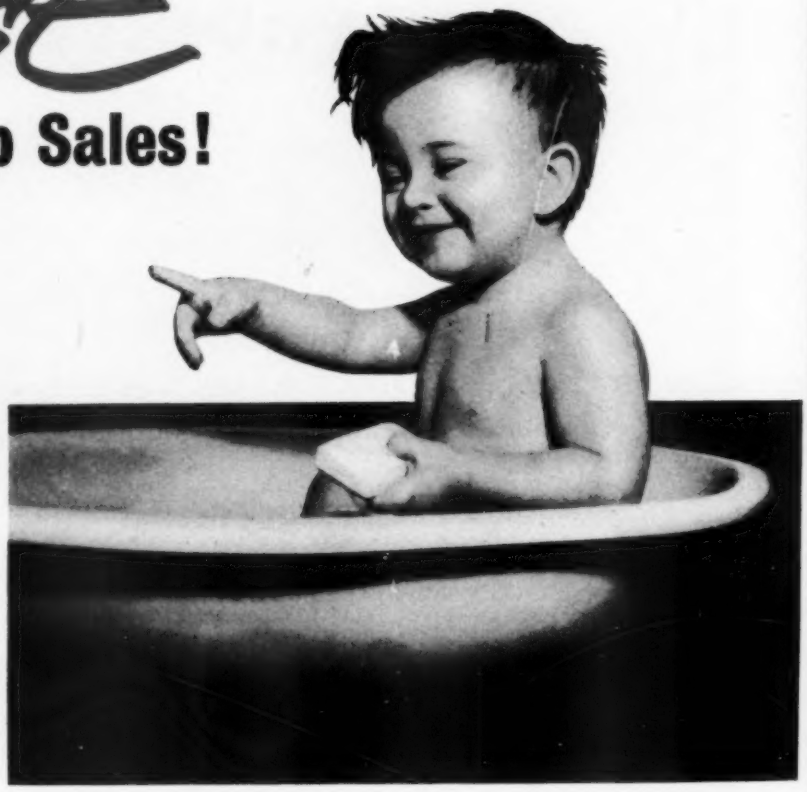

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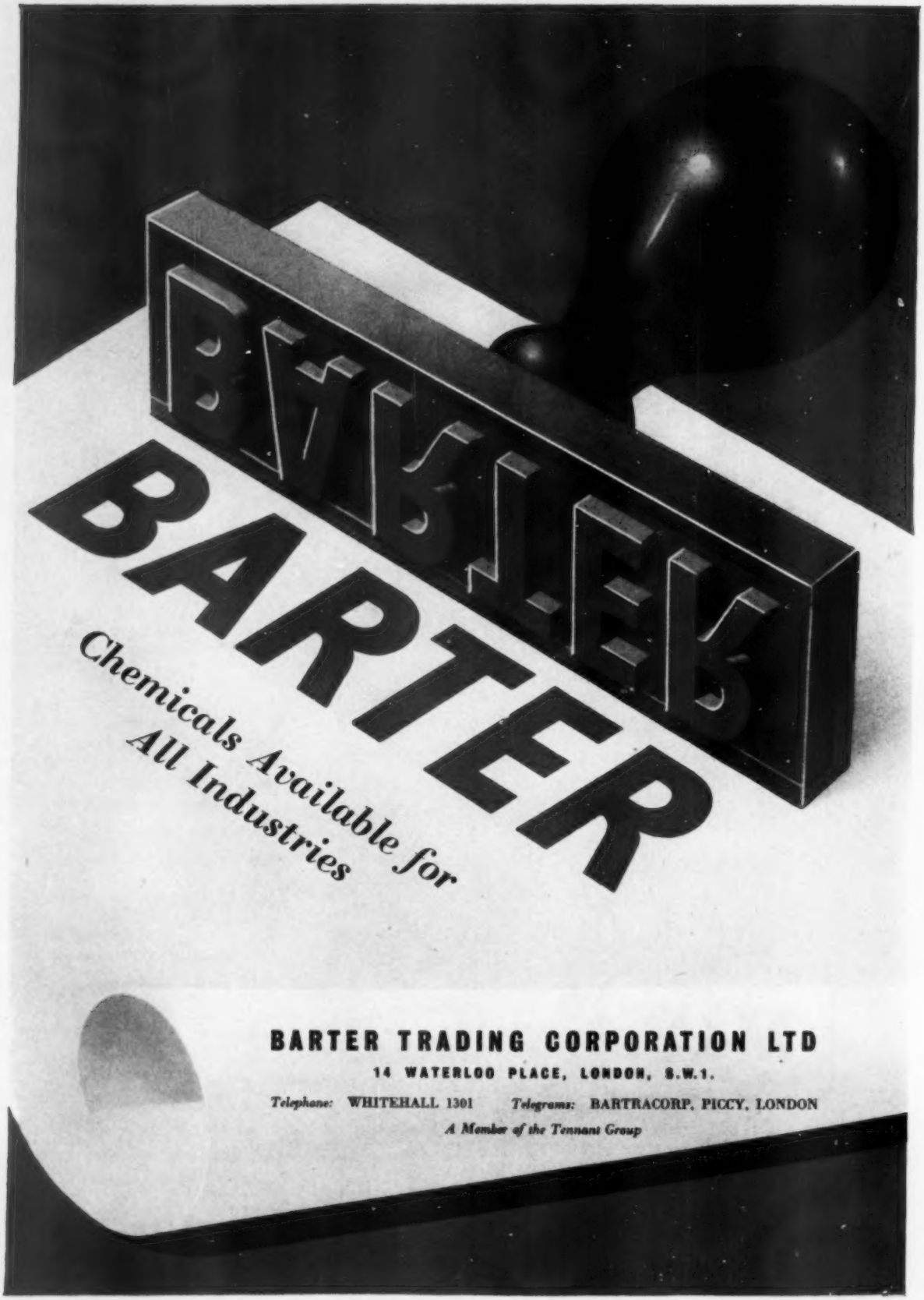
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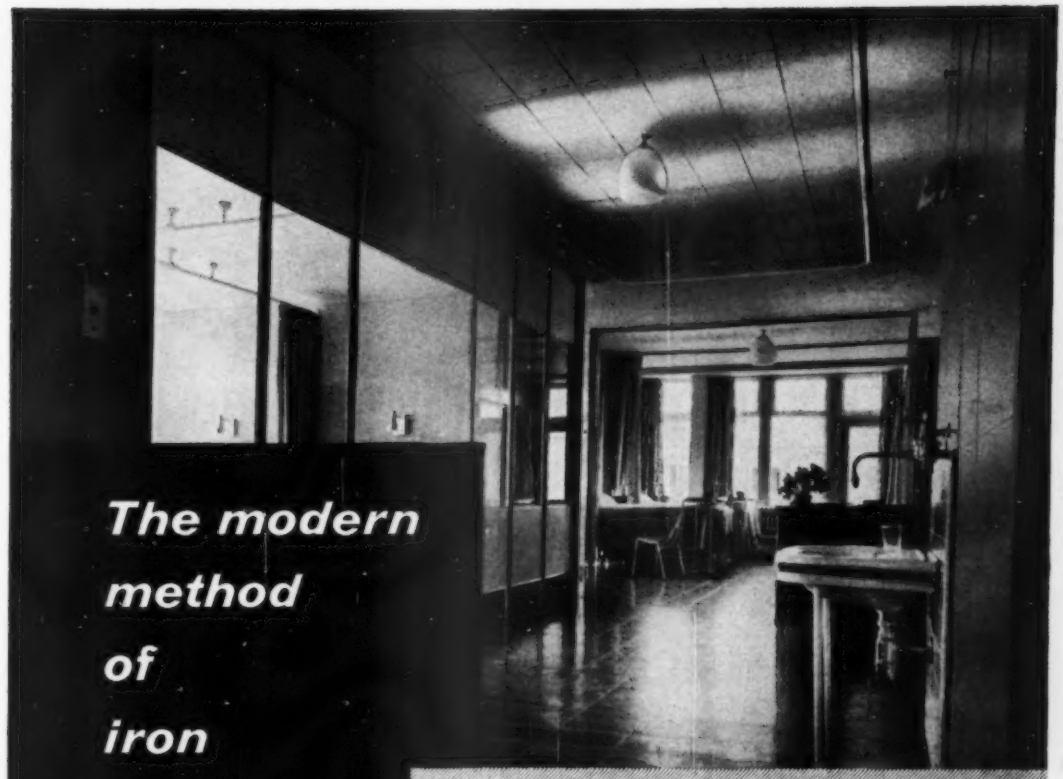

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G. AA19

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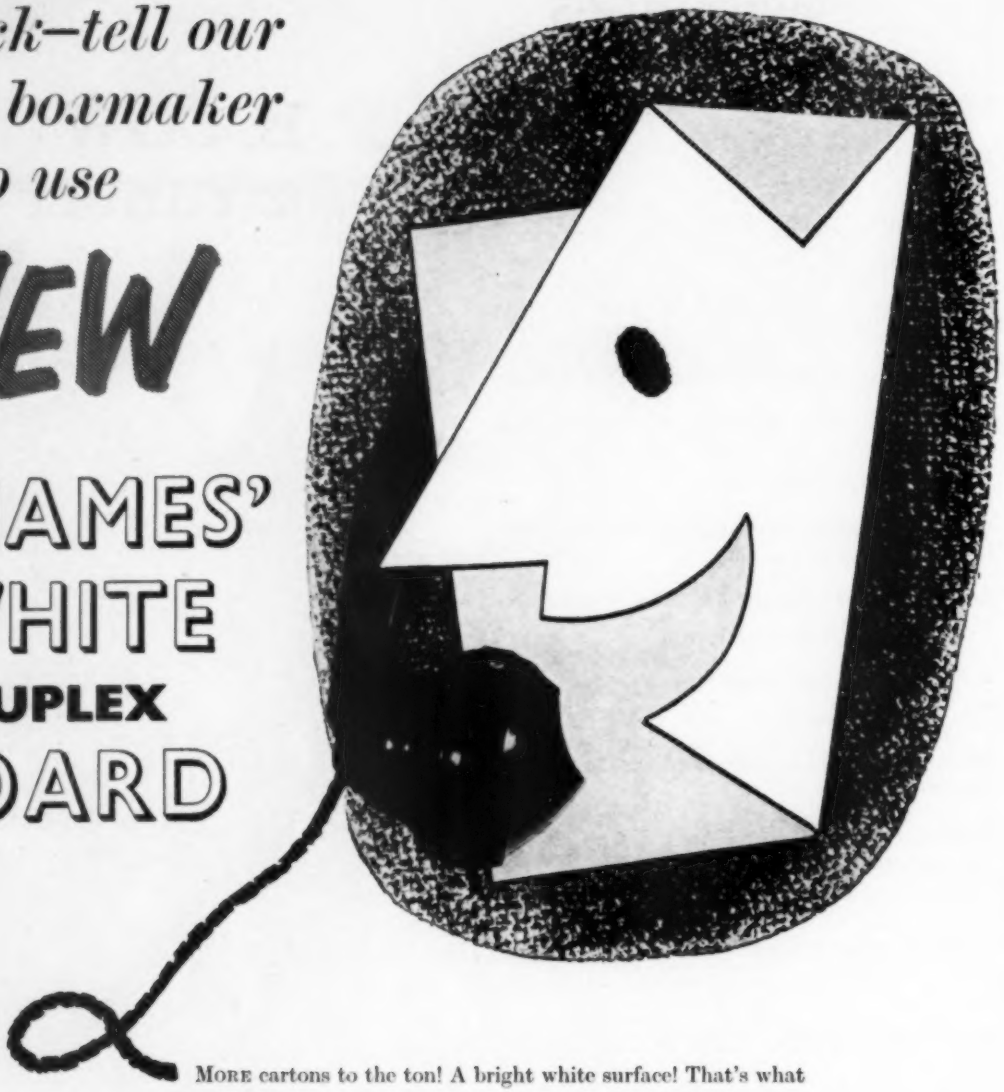

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TOPICS AND COMMENTS

Sabin versus Salk

IN THIS issue we publish a description of the elaborate and expensive new laboratories which Burroughs Wellcome have built for vaccine manufacture. The first building to be completed under the expansion programme at Beckenham was the polio vaccine unit. This unit, like Glaxo's at Sefton Park, Buckinghamshire, and Pfizer's at Sandwich, is now working flat out to increase supplies of vaccine to meet the demand precipitated by the death from polio of a popular footballer. It is a curious commentary on present-day attitudes among younger people that this single tragedy has done more to persuade them to accept vaccination than all the articles in the newspapers and all the pronouncements of the Ministry of Health. The singular lack of interest in vaccination before the death of Jeff Hall is the more remarkable when one recalls the bitter complaints about the shortage of supplies two or three years ago. M.P.s got up in Parliament and demanded as a sacred right of the British people that vaccine should be made available instantly, from whatever source and at whatever cost. Since then three firms have spent over £2 million to build manufacturing units and, until a few weeks ago, thousands of people in their teens and twenties who were offered the fruits of this enormous and costly effort quite free were simply not interested.

The complexity of making Salk vaccine is obvious from the brief article published in this issue. Glaxo have just published a lengthy, lucid and informative booklet on their *Polivirin* vaccine. It is beautifully designed and illustrated and should certainly be read by those people who imagine that these complicated products can be turned on and off like tap water.

Now that Britain has adequate facilities for making Salk vaccine, it seems that soon further efforts will be needed to develop the live vaccine which has been pioneered by Dr. Albert B. Sabin of the University of Cincinatti. The Sabin vaccine would be easier to make than Salk, would be administered by mouth, and would be vastly more effective. Unlike Salk vaccine, it could be used to prevent an epidemic of polio and it might come near to eliminating paralytic polio. In the *B.M.J.* (1959, (5123), 663) Sabin presents evidence that living attenuated virus can prevent infection of the intestine with other strains of polio virus—probably soon after the ingestion of the vaccine. Living attenuated virus can also pass freely from person to person so that its prophylactic effects would spread rapidly in a community. However, before this can be hailed as an advantage, it will have to be proved that passage through the intestines does not reactivate the virus to a dangerous extent. Virologists have doubts on this at the moment.

Living polio vaccines are being tested in many parts of the world and soon most of the answers to this and other questions will be obtained. Should oral polio vaccine prove to be medically acceptable it is unlikely that Salk vaccine will survive. So far as this country is concerned, all that can be said at present is that if Sabin prevails over Salk we are in a better position to make the new vaccine that we were when Salk vaccine was first introduced in the U.S.

A new organisation of cosmetic chemists

SINCE the war the formal organisation of cosmetic chemists has proceeded apace. First there was the Society of Cosmetic Chemists in the U.S. This was followed by the Society of Cosmetic Chemists of Great Britain and now several European countries have similar societies. The opportunity provided by the British Congress of Cosmetic Science, held in London last month, was taken to build the framework of a proposed International Federation of Societies of Cosmetic Chemists. In the rooms of the Chemical Society, on April 15, agreement was reached on a draft constitution by representatives of societies from the U.S., Belgium, Germany, Switzerland, Denmark, Norway, Spain and Great Britain. This draft will now be considered by the individual societies and, if all goes well, the Federation may come into being in September 1960.

An important provision of the draft constitution is that the establishment of a Federation will in no way interfere with the autonomy of the national societies. It is envisaged that the Federation will provide a link between the individual societies in the establishment of international standards for cosmetic raw materials and in enhancing the professional status of cosmetic chemists. There is also the possibility of the Federation publishing an international bulletin.

At this stage it seems that one of the most useful functions of the Federation would be the co-ordination of international standards for raw materials and cosmetics. Many companies in the industry operate internationally and there is also the question of the European Common Market. Everything that can be done to raise standards in the industry is to be welcomed.

Apart from the scientific sessions, a further report on which appears in this issue, the proposed Federation was the most important piece of news arising from the Congress which, incidentally, drew a large and enthusiastic attendance from this

country and 18 overseas countries. There was a welcome disposition on the part of Congress members to take their industry and their work seriously and there was talk of a central research station for cosmetic science. Bearing in mind the considerable contribution of cosmetics to the Revenue in the form of purchase tax, the industry would be justified in asking for a D.S.I.R. grant towards the cost of setting up and running a research station. But the industry itself would have to make a substantial contribution and the impression left on some observers is that a great deal of persuasion would be needed to get agreement on which firms are going to foot the bill. Some people think that cosmetics are a branch of preventive medicine, but many others would hesitate to put their work and their aspirations on this lofty plane.

Corrosion comes to town

SPEAKING so soon after the announcement of tax changes in the Budget, Sir Owen Wansbrough-Jones, Chief Scientist of the Ministry of Supply, struck a topical note when he remarked at the opening of the Corrosion Exhibition that the cost of corrosion to this country was equivalent to 2s. in the £ on the standard rate of income tax. This was based on the widely-quoted estimate that corrosion costs Britain £600 million a year, an estimate that Sir Owen found slightly unbelievable but which, so far as we know, has not been challenged.

Whatever argument there may be about the magnitude of corrosion costs, there is no doubt that corrosion does a great deal of damage in more subtle ways than direct destruction. It is responsible, for instance, for losses in reliability, extra wear on mechanical equipment and extra costs of maintenance. Sir Owen thought that scientists might well give more attention to the maintenance of reliability by proper corrosion prevention.

Sir Owen praised the organisers of "this large and admirable exhibition" and, indeed, his description of it was strictly accurate, for it was probably the biggest exhibition of its kind ever to be held in Europe, perhaps in the world. The New Hall of the Horticultural Society in Westminster was packed with the displays of some 80 exhibitors and the large and keenly interested attendance convincingly demonstrated that the exhibition has made a permanent niche for itself in the calendar of technical exhibitions.

The exhibitors—large and small—deserve praise for their skilful exposition of the gospel of corrosion technology, and it is clear that there will be keen interest in the next exhibition which, as in the case of the 1957 and 1959 shows, will be organised by our associated journal *Corrosion Technology*. Firms wishing to participate in the next exhibition will be advised of the time and place and all enquiries should be addressed to *Corrosion Technology*, 9 Eden Street, London, N.W.1.

A detergent to end bubble trouble

IT now seems possible that we shall have detergents that will not fill rivers full of foam after discharge in effluents. Ever since excessive foam became a serious nuisance manufacturers have been trying to effect a compromise between the need for foam in the kitchen sink and bubble trouble in the sewage works. Since January 1957 their efforts have been guided by the Standing Technical Committee on Synthetic Detergents set up by the Minister of Housing and Local Government. Now, in their second report,* the Committee say that a new type of alkyl benzene sulphonate has been found to fulfil commercial requirements while promising to meet the requirements of the sewage works. In short, it gives rise to less river pollution and produces little, if any, more foam than do effluents containing no detergent at all. Biological filtration or aeration with activated sludge removes up to 94% of the new detergent, compared with 67% of present material.

The development of this new detergent will be generally welcomed for foam continues to be a serious problem at a number of sewage works and on certain rivers and canals. Opinion still appears to be divided on the relative merits of sewage effluent sprays and chemicals as foam suppressants at sewage works. The Committee report that the London County Council have been considering the possibility of intensive aeration of the influent to an activated sludge plant so that surface-active material can be removed in the form of foam and so be kept out of the Thames. A large experimental plant is being considered to apply the methods on a works scale and see if they are economically possible.

The Committee are satisfied that there has been no detectable change in the average concentration of synthetic detergents in sewage, effluent, and river water during the past two years. No new aspects of the problem have been reported to the Committee nor has there been any major change in the composition or volume of detergents retailed.

Synthetic detergent toilet bars are being test marketed in this country. The indications are that the surface-active agents incorporated in them are readily decomposed biologically and their use is not likely to affect the problem adversely.

Experiments at Durham University indicate that the sugar-based detergents are readily broken down by bacteria, but it appears to the Committee that considerable development work will be needed before it is known whether these materials can offer a satisfactory alternative to materials at present used for making domestic detergents.

The Committee describe an investigation into the toxicity of synthetic detergents to fish. The general conclusion was that in the concentrations likely to be found present in British rivers detergent residues discharged with sewage effluents are unlikely to exert any appreciable toxic action on fish.

* Second Progress Report of the Standing Technical Committee on Synthetic Detergents. H.M.S.O. 9d. net.

Instrumentation in Russia

THAT in technical matters the Russians are vigorously self-critical is plain from the extracts from their technical press which are now appearing in the *LLU Translations Bulletin*, an admirable new monthly publication of the D.S.I.R. An article on instrument manufacture which appeared in a recent issue illustrates their realistic approach. It is admitted that in spite of an increase in instrument manufacture of over 500% in the seven years from 1950, industrial demands are nowhere near to being met, either in quantity or quality. For example, two instrument factories are criticised for making pressure gauges, manometric thermometers and direct-acting regulators which have a service life of only six to ten months! At the 20th Congress of the Communist Party a programme for the widespread automation of industrial processes was outlined and the building of 32 new instrument manufacturing units was proposed. During 1959-1965 it is hoped to quadruple the output of industrial instruments, including an eight- to tenfold increase in the output of control and regulating instruments.

The Russians, of course, are especially interested in the automation of chemical analysis and in process control. As an example of the advantages of automatic control of chemical processes the achievements in the fermentation alcohol plant of a synthetic rubber factory are quoted. Here, the adoption of automatic control for the catalytic decomposition of alcohol resulted in an 18% cut in the labour force, an annual saving of 570 metric tons of alcohol and an annual saving of 2,460 metric tons of grain. The cost of automation was recovered in 2½ months.

The author of the article is critical of shortcomings in automatic chemical analysis. He estimates that automation of analytical control would release no fewer than 20,000 routine analysts for more productive work in the chemical industry. In this field, instrument makers are required to design and produce an extensive range of apparatus for the analysis of gases and liquids based on thermal conductivity, thermochemistry, magnetic and other methods. Other analytical techniques which they are advised to utilise include photocolorimetry, refractometry, mass spectrometry, chromatography and nuclear magnetic resonance.

Another important task for Russian instrument designers is to develop a standard series of primary control elements. Lack of standardisation generally is handicapping the wider use of automation in the Soviet Union. Instruments developed by one organisation often cannot be used elsewhere, with a consequent waste of effort and money. To correct this the establishment of a State Instrument System is proposed which, above all, will strictly regulate the input and output parameters of primary control or sensitive elements, controllers, final control mechanisms and other automation equipment.

Instrument research and development facilities will have to be considerably increased and two new institutes for this work are planned. To achieve closer links between design and production, it is proposed to hand over to the research institutes several instrument factories.

If it is fulfilled, this blueprint for expansion in industrial instrumentation and automation will bring Russia abreast of the most advanced Western countries. It could have a profound and widespread effect on Russian industrial efficiency within the next 10 years and may even make her an important instrument exporting country.

Jacob Bell Centenary

IF ever a man devoted his life to a cause, that man was Jacob Bell, founder of the Pharmaceutical Society, the centenary of whose death falls on June 12.

The son of a pharmacist, whose Oxford Street business (John Bell and Croyden) he joined as soon as his education at a Darlington Quaker school in Yorkshire was completed, Jacob Bell had his health ruined, when thirty, by a severe attack of quinsy while on holiday with Landseer in Geneva. Ever after he was a martyr to laryngeal trouble, but he never allowed ill-health to interfere with his services to pharmacy.

A parliamentary measure, in 1841, which would have badly hit all chemists and druggists, and which Bell's efforts helped to quash, opened his eyes to the necessity of a society for the protection of the trade. So on April 15, 1841, he called a public meeting at which it was decided to create a Pharmaceutical Society of Great Britain.

All the formidable difficulties in its organisation were ably handled by Bell, who also founded the *Pharmaceutical Journal* to assist in the furtherance of the cause. This he fathered for eighteen years, and contributed to it regularly all his life, a true labour of love for a periodical that, for fifteen years, showed no profit.

The four essentials for which Bell fought were (1) a proper system of training and examination for pharmacists; (2) protection of the public from the quack pharmacist; (3) separation, as far as possible, of the medicine trade from the doctor's practice; (4) recognition of the Pharmaceutical Society as governing body.

Finding himself powerless to implement these conditions while outside parliament, he became Liberal M.P. for St. Albans in 1850, and introduced a pharmacy bill the following year. After much delay, an attenuated version of it became law. At the 1852 General Election, Bell was not returned, and two years later again failed to be elected. But he never ceased to work on behalf of pharmacy, even in the last year of his life when he finally died of exhaustion after terrible suffering at the early age of 49. On the day of his funeral scarcely a chemist in the kingdom opened up his business.

The waters of Lethe

THROUGHOUT the ages man has shown considerable ingenuity in either finding or developing substances with which to intoxicate himself. Disregarding Lethe, that river in Hades whose waters produced, in those who drank them, forgetfulness of the past, these have ranged from *amanita muscaria*, or fly agaric, popular with the Koryaks of Siberia, a thrifty people who find that it can be used again and again, since the active constituent, muscarine, passes through the body unchanged, to the homely pint of bitter indulged in at the local. Man's need to escape from himself, or at any rate his surroundings, would appear to be approaching a new peak today with the greatly increased use of tranquillisers and "pep" pills either alone or as an adjunct to alcohol. For example, according to the Medimetric Institute of New York, Americans consumed 1,250,000,000 tranquillising pills in 1957, while reports from Japan indicate that, after an epidemic of amphetamine abuse in 1954 involving some one million people, there is now a similar tendency to swallow tranquillisers.

According to a report in *World Health* doctors are being forced by their patients into what are succinctly described as "shotgun prescriptions." The patient reads of some new "miracle pill" which will stop him from worrying, make him more efficient and generally make life more pleasant and naturally asks the doctor to prescribe it for him. The doctor can hardly be blamed for giving in to these requests, the report says, since the products are so intensively advertised in medical journals that the doctor would have to be a superman to resist this propaganda.

The defence put forward by the champions of tranquillisers and "pep" pills that they are necessary because modern life is beset with anxiety and that, anyway, the pills have no dangerous side effects, is doubtful. Certainly it is simply not true that all stimulants and tranquillisers are entirely devoid of paralysing effects. Lately there have even been some observations about the unfortunate influence of both stimulants and tranquillisers on the behaviour of car drivers. One can be sure that "pep" pills and "happy" pills tend to produce a kind of paralysis of the feelings of responsibility without which the orderly functioning of modern society is completely impossible.

A certain amount of worrying about the consequences of our actions would seem to be necessary for living a healthy mental life. Tranquillisers have lately been recommended for use in animals about to be slaughtered, in order to prevent panic; horrifying parallels can be drawn from this statement.

It is true enough that in a world like ours a great deal of neurotic anxiety and tension is being produced, yet a certain amount of normal anxiety is one of the factors that contribute to cultural progress.

Prosperity in Berlin

To the outsider it seems remarkable that West Berlin, a focal point of international political strife, can flourish as an economic unit. First came the destruction of the city in the last weeks of the war. Then came the Russian blockade in 1947. Since then there have been periodical upheavals, threats and counter-threats. Yet today West Berlin, a community of 2,200,000, is the prosperous centre of many industries and, indeed, is the largest industrial city of the German Federal Republic.

In 1950 there were 150,000 people working in Berlin's factories and the total turnover stood at 1·77 billion Deutsche Marks. By 1958 the turnover had increased to 7 billion DM and the number of employees to 290,000. Berlin has always been a centre of chemical research and chemical industry and today the industry has a turnover of 440 million DM and employs about 17,000. The pharmaceutical industry of the city accounts for over 164 million DM of the total chemical turnover and, indeed, produces 8% of the total pharmaceutical production of West Germany.

In the past 10 years there has been severe competition among Berlin pharmaceutical firms and over half of them have been forced out of business. However, there are still 65 companies. Though the number of companies has dwindled the number of employees has increased and now stands at over 5,000.

The dominant firms in Berlin pharmaceuticals are those which have been established for many years. They include Schering, Riedel-de Haen, Rudolf Reiss, Gerhard Mann, Heyl and Co., and Georg Henning. The original J. D. Riedel company was started in 1814 and Schering in 1871. Heyl and Co. was started in 1926. Between them these firms have developed many well-known specialities, in the field of hormones, barbiturates, anti-rheumatics, vitamins, cortisones and antibiotics.

Pharmaceuticals account for 50·2% of the industry's output, and vitamins and hormones for 35·9%. Fine chemicals, galenicals, veterinary preparations, disinfectants, dental preparations and homeopathic and biochemical products account for the remainder.

It is obvious that the industry could not have grown so strikingly without exports. In fact it now exports 40% of its output. European countries are the best customers, closely followed by South America. Australia takes no less than 6% of the exports and even the United States takes 8%. The value of exports is 67·76 million DM.

The nature of the pharmaceutical industry makes it particularly suitable for development in the difficult circumstances in which Berlin has had to survive. A city so dependent on air communications will naturally seek to excel in products which concentrate a high value in a small space. Nevertheless, the prosperity of the industry is a considerable achievement and reminds everyone of the traditional German skills in chemistry and pharmacy.

Expansion in the British Pharmaceutical Industry

"Manufacturing Chemist" Survey Reveals £8·6 Million Expenditure on new Laboratories, Factories and Plant

In the past few months we have approached some 200 firms in the pharmaceutical and fine chemical industries for details of recent or proposed expansion projects. Approximately 10% have been able to give us the required information, but this does not, of course, mean that only these firms have built new plants or laboratories in the past year or so or plan to do so in the immediate future. For various reasons a number of firms have felt unable to accept our invitation. Our survey, limited as it is, underlines a well-known fact: that a great deal of new expansion is being undertaken by British associates of U.S. firms.

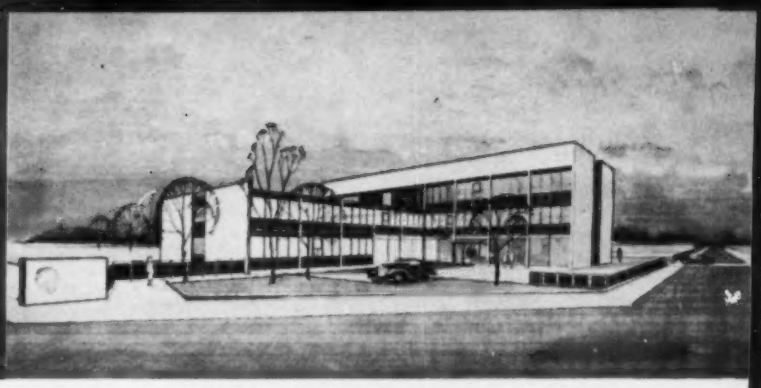
Four questions were asked: 1. What is the size and purpose of the new project, and when was it put into service or is due to be put into service? 2. If a manufacturing unit, name the products and output by volume or value. 3. What was the cost? 4. Who were the main contractors and suppliers?

Not all firms who responded answered all these questions. Fourteen firms gave expenditures—money either spent or due to be spent. The total sum is £8·6 million, a figure which strikingly shows the heavy financial obligations involved in modern pharmaceutical industry.

Name of firm	Projects	Products	Costs	Main contractors and suppliers
BOOTS PURE DRUG CO. LTD., NOTTINGHAM.	Seven-storey building containing 24 research laboratories. Opened April 1959.	Pharmacological research.	£750,000.	Boots' own architects. William Moss and Sons (main contractors).
	Warehouse building providing 150,000 sq. ft. and containing a dock, five floors and a penthouse. Opened 1958.	Carries stock of 30,000 different lines. Annual output approx. 20,000 tons.	£700,000.	
BRITISH SCHERING MANUFACTURING LABORATORIES LTD., HAZEL GROVE, STOCKPORT, CHESHIRE.	Powder filling section of 550 sq. ft. and powder mixing section of 800 sq. ft. in single-storey building. Put into service January 1959.	*Neutradonna* powder. Initial rate 50 tons p.a., capacity 200 tons p.a.	Approx. £3,800.	Pre-breaker and drum mixer by Booths, *Kek* pin mill and rotary valves. Russell sieve. Albro filler. Gardner Elevator. Alite elevator.
E. H. BUTLER & SON LTD., LEICESTER.	Transfer of Thornton Lane warehouse (wholesale) and Humberstone Gate unit (manufacturing and dispatch) to new premises at Brunswick Street with overall space of 32,000 sq. ft. Transfer to take place between April and August 1959.	General galenical ointment and tablet manufacture. Packing of all pharmaceutical products.	Building £40,000. Fittings, etc., approx. £15,000.	—
CYANAMID OF GREAT BRITAIN LTD., GOSPORT, HANTS.	Factory for Lederle laboratories division at Gosport for the production of antibiotics, certain organic synthetic drugs and general pharmaceutical processing including soft shell encapsulation, tablets, parenterals, surgical products, liquids, ointments and final packaging. sq. ft. Total area ... ... 86,000 Production ... 33,000 Warehousing ... 28,000 Laboratory ... 6,000 Engineering, etc. ... 5,000 Offices and canteen 14,000	*Aureomycin* *Achromycin*. *Diamox* (Acetazolanide). *Artane* (Trihexyphenidyl). Numerous pharmaceutical formulations of the above drugs together with a wide range of multivitamin preparations. A comprehensive range of surgical sutures.	Total capital cost, including buildings services, installation charges—but not including production plant and equipment—was £749,000.	C.A.S. Ltd., (Builders) R. M. M. Douglas Ltd. Birlec Ltd., A.C.I. Ltd., Le Bas Tube Co. Ltd. F. H. Wheeler Ltd. Llewellyn, Smith and Walters (architects).

Name of firm	Projects	Products	Costs	Main contractors and suppliers
CIBA LABORATORIES LTD., HORSHAM, SUSSEX.	Tablet manufacturing plant, packaging room and warehouse space of a total floor area of 34,000 sq. ft. with boiler house 2,200 sq. ft. Put into service in July 1958.	A wide range of Ciba tablet specialities. Manufacturing capacity, about 1,000 million tablets p.a.	£230,000	Builders: John Laing and Son Ltd. Architects: J. Douglass Mathews and Partners.
THE DISTILLERS COMPANY (BIOCHEMICALS) LTD., SPEKE, LIVERPOOL.	Two-storey pharmacological laboratory for product testing and investigation. Due to be opened November 1959.	—	£80,000 plus.	Sir Alfred McAlpine and Son Ltd.
DUNCAN, FLOCKHART & CO. LTD., EDINBURGH.	New chemical development laboratories to accommodate seven chemists, and new biological laboratories for three pharmacologists, including pilot plant with flameproofed equipment. Extensions to biological laboratories with animal rooms. Opened November 1958.	—	£20,000.	Contractor for laboratory furniture: Nathaniel Grieve, Edinburgh.
EVANS MEDICAL SUPPLIES LTD., SPEKE, LIVERPOOL.	Research laboratories situated on a 30-acre site at Speke. Completed in 1958 and occupied in January 1959. Most of the company's research will be accommodated in this building.	—	—	J. Jones and Co. (Walton) Ltd., Widnes.
GLAXO LABORATORIES LTD., GREENFORD, MIDDLESEX.	New *Farex* department and storage unit, Greenford. In service, September, 1958.	*Farex*, *Casilan* and dextrin.	—	Richard Costain Ltd.
	New pharmacy unit, Greenford. Completed in October 1958.	Pharmaceuticals.	—	
	Virus research unit extension, Greenford. Completed in December 1958.	Immunologicals, including influenza, diphtheria and tuberculosis vaccines.	—	
	New warehouse at Dukinfield, Cheshire. Completed in May 1958.	Improvement to distribution facilities.	—	Jackson Bros., Manchester.
	New warehouse at Bargeddie, Glasgow. Completed in September 1958.			A. A. Stuart and Sons, Glasgow.
	New plant growth rooms, Sefton Park, Bucks. Completed in September 1958.	For production of plants under controlled conditions for testing agricultural antibiotics.	—	Prestcold Refrigeration Ltd., Oxford.
JOHN KNOX (STOKE-ON-TRENT) LTD., STOKE-ON-TRENT.	Warehouse—5,000 sq. ft.—is in the centre of Blackpool for supply of medical and surgical requirements to the Fylde area and N.E. England. Same day delivery service will be given to all pharmacists in the area. Ready April 1959.	Wholesale distribution only.	£16,000-£20,000.	—
MAY AND BAKER LTD., NORWICH.	Chemical factory on 175-acre site at Sweetbriar Road. Officially opened May 1957 but is being continually developed on 20-year plan. Present labour force 100. Twenty-year target is 3,000 workers, making factory main M & B production centre.	Caffeine, theobromine. Selective weedkillers: *Tropotox* and *Tropotox plus*.	—	H. Pointer (Norwich) Ltd. R. G. Carter Ltd. Consulting architect: B. M. Feilden, *A.R.I.B.A.*
MAY AND BAKER LTD., DAGENHAM.	Manufacturing laboratories. Multi-storey building covering 45,000 sq. ft.	Production and packaging of tablets and ampoules.	—	—

Boots: The research block at Nottingham which contains 24 laboratories.



Evans Medical: An architect's drawing of the new research laboratories at Speke.

Name of firm	Projects	Products	Costs	Main contractors and suppliers
MERCK SHARPE & DOHME LTD., HODDESDON.	Now under construction 10,000 sq. ft. office area and 75,000 sq. ft. of production and dispatch area. Building has ground and two upper floors to provide the most up-to-date facilities for the manufacture of pharmaceuticals. The design allows for expansion in any department. Should come into service by January 1960. Part of 15-20 year expansion programme.	Full range of MS & D products including the latest developments: *Inversine*, *Saluric*, *Dekadron*, *Hydro Saluric*. Plant will handle upwards of 15 million packages p.a.	Overall expenditure will be over £1m. Present part of scheme about £500,000.	Holland and Hannen and Cubitts and associated companies. Architects: Edward D. Mills and Partners.
MONSANTO CHEMICALS LTD., RUABON, WALES.	Conversion of synthetic phenol plant from batch to continuous operation. Completed in 1958.	Phenol, including phenol B.P.	—	—
	Expansion of aspirin plant and salicylic acid plant. For completion by end of 1960.	Aspirin. Salicylic acid.		
	New phenacetin plant. For completion by end of 1960.	Phenacetin.		
	Expansion of paraphenetidine plant. For completion by end of 1960.	Paraphenetidine.		
THOMAS MORSON & SON LTD., PONDERS END, MIDDLESEX.	General organics unit, a building which is on two floors and covers an area of 3,600 sq. ft.; has been designed for the synthesis, organic and inorganic, of fine chemicals. Equipped with glass-lined and stainless steel reactors, together with such ancillary equipment as extractors, filters and centrifuges piped with glass and stainless steel pipe for maximum adaptability. The building is designed to house further equipment when this becomes necessary. A small laboratory is included in the building for routine process testing together with a Drying Room. The building has an acid brick floor and is fully ventilated. It is expected that the Unit will be in operation in June 1959.	Amyl nitrite. Chlorbutol. Propargyl bromide. Sulphonamides. Other organic chemicals and pharmaceuticals.	Approx. £150,000.	Flowsheet for the installation was drawn up by the Engineering Division of Morson's parent company in New York and the design and selection of equipment, together with the design of the building, has been in the hands of their own Engineering Dept. Building contractors: Turriff Construction Corporation Ltd. Piping contractors: Jenning Bros. (London) Ltd.
PARKE, DAVIS & CO. LTD., HOUNSLOW, MIDDX.	A two-storey chemical block; 170 ft. by 60 ft. This unit provides great flexibility of design and layout.	—	—	Fassnidge Son and Norris of Uxbridge.

Name of firm	Projects	Products	Costs	Main contractors and suppliers
PARKE, DAVIS & CO. LTD., HOUNSLOW, MIDDX.	A new pharmacological research wing, 60 ft. by 120 ft., greatly extending the company's activities in this field.	—	—	F. D. Hidden of Boston Manor. Truett and Steel of Thornton Heath.
	A new building 20 ft. by 60 ft., to provide for extended biological assay needs.	—	—	
	A new area for ancillary services covering 63,000 sq. ft., to provide for bottle-washing and storage, engineer services, packing and stock rooms and a modern loading dock.			
	All of these new facilities are now in use with the exception of the storage buildings, which are expected to be completed and handed over during the next month or so.			
PFIZER LTD., FOLKESTONE AND RICHBOROUGH, KENT.	Antibiotic production: Additional facilities to increase output. Now due for service.	*Terramycin, Tetracyn, Matromycin.*	Several hundred thousands of pounds.	G. N. Haden and Sons Ltd. (Piping). C. Jenner and Sons (Builders). S. W. Bligh Ltd. (Electrical). Stainless Steel Vessels Ltd. (Tanks, etc.). Clark Bros. (Compressor Equip.).
	Organic synthesis: General improvement in production facilities to increase versatility of plant now in service.	Steroids (*Cortril, Delta Cortril*) and organic chemicals.	£500,000 plus.	G. N. Haden and Sons Ltd. (Piping). C. Jenner and Sons (Builders). S. W. Bligh Ltd. (Electrical). Stainless Steel Vessels Ltd. (Tanks, etc.). Enamelled Metal Products Ltd. (Glass-lined Vessels). LaBour Pumps Ltd. (Pumps). Worthington Simpson Ltd. (Pumps).
	Pilot plant: To improve investigational work on fermentation and organic synthesis compounds. Completion in April/May 1959.	—	About £100,000.	
	Research: Veterinary and nutritional research facilities now ready for stocking with animals.	—	—	C. Jenner and Sons Ltd. (Builders). Pratten and Co. (Portable Bldgs.). R. H. Hall and Co. (Portable Bldgs.). S. W. Bligh Ltd. (Electrical). G. N. Haden and Sons Ltd. (Piping).
	Vaccines: New laboratories at Richborough. Area: 30,000 sq. ft. divided into 200 separate rooms. Production started early 1958.	Ten million doses p.a. of polio vaccine. Capacity: 20 million doses.	£1,000,000.	—
SMITH KLINE & FRENCH LABORATORIES LTD., WELWYN GARDEN CITY, HERTS.	New pharmaceutical and research laboratories together with manufacturing plant and offices. Occupying 164,000 sq. ft. on a 9-acre site at Welwyn Garden City. Designed to allow for both horizontal and vertical expansion. Commenced May 1958—commissioning date August 1959. The company's chemical factory will remain at Tonbridge, Kent.	Pharmaceutical and veterinary products.	Around £1,000,000.	Consultant architect: Sir Leslie Martin. Consultant engineers: Ove Arup and Partners. Main contractor: Wm. Sindall Ltd., Cambridge.

Parke, Davis: The new chemical block at Hounslow. This building provides great flexibility of design and layout.

Glaxo: Main control for the three growth rooms at the Sefton Park laboratories.

Name of firm	Projects	Products	Costs	Main contractors and suppliers
WELLCOME RESEARCH LABORATORIES LTD., BECKENHAM, KENT.	Three-storey building providing 25,000 sq. ft. for polio vaccine manufacture. Opened January 1957.	Four million 1 c.c. doses of polio vaccine p.a.	£250,000.	
	Two buildings of same size and dimensions as above for manufacture of virus vaccines and for research and development. Also houses polio vaccine testing laboratory. Each building covers 25,000 sq. ft. Opened January 1959.	Yellow fever, canine distemper, influenza, canine hepatitis and other virus vaccines.	£450,000.	
	Two-storey building for research on and production of anaerobic bacterial vaccines, covering 30,000 sq. ft. Opened January 1959.	Veterinary vaccines—e.g., lamb dysentery, pulpy kidney, black disease, blackleg, blackwater, braxy and enterotoxæmia vaccines.	£300,000.	—
	50,000 sq. ft. building for research on and development and production of antisera for human and veterinary use and for various prophylactics. Due for completion early 1960.	Diphtheria, tetanus and gas gangrene antitoxins, lamb dysentery and pulpy kidney antisera, tetanus and diphtheria prophylactics and combined pertussis and polio prophylactics, etc.	£500,000.	—
	25,000 sq. ft. three-storey building for pharmacological research to be linked with existing chemical research laboratory.	Pharmacological research.	£250,000.	—
	Re-equipment and rebuilding of penicillin factory for conversion to biochemical dept., covering 40,000 sq. ft.	Biochemicals.	£125,000.	—
JOHN WYETH & BROTHER LTD., HAVANT.	Manufacturing plant of 81,500 sq. ft. Put into service in 1958.	*Algipan, Aludrox, Beplete, Beplex, Endrine, Equanil, Equaprin, Evramycin,* etc.	Approx. £600,000.	Humphreys Ltd., London. Consulting Engineers: Thomas Bedford and Partners.
	Research and development division of 19,000 sq. ft. Put into service in 1958. Projects involving further £60,000 being put in hand this year.	—	Approx. £218,000.	

INTERFERON—A New Approach to Virus Chemotherapy

By D. C. Burke, B.SC., PH.D.*

Interferon, a substance produced by heat-inactivated virus—e.g. influenza virus—has been shown to interfere with the growth of viruses as different as influenza and vaccinia. Since it is non-toxic, it is potentially a powerful and completely new approach to virus chemotherapy. But many snags have to be overcome. Here is an assessment of the complex situation by a chemist who has worked closely with the discoverers of interferon at the National Institute for Medical Research.

DESPITE the spectacular progress that has been made in the chemotherapy of bacterial infection, little progress has been made in effective chemotherapeutic control of viral disease. Excluding the lymphogranuloma-psittacosis groups of large animal viruses, which are now classed with the rickettsiæ, there is no well-established example of the effective chemotherapeutic treatment of a virus infection. The difficulty is due to the way in which viruses multiply. The bacterial pathogens have a metabolism of their own, different from that of their hosts, and this means that they can often be killed by a drug or an antibiotic which does not harm the host. There is much yet to be learned about the mechanism of virus multiplication, but enough is known to make it quite clear that the metabolism of the virus is very closely related to that of the host. This may clearly be seen as we follow the course of an invading virus particle. All viruses, whether bacterial, plant or animal, appear to go through what is known as an "eclipse phase." That is to say that shortly after virus infection of a cell there is a period of varying length during which extremely little virus can be found in the cell, probably because the virus splits up after entry and before multiplication starts. At the end of the eclipse phase virus appears first within the cell and is then released into the surrounding fluid. With some viruses, the "latent" viruses, the metabolic processes of host and virus are so closely intertwined that the virus stays in the cell in a non-infectious form, reproducing as fast as the cells divide, and only occasionally appearing as infective virus. The virus causing cold sores (herpes simplex virus) is a case in point.

Viruses have few enzymes, and certainly not a sufficient array of enzymes to synthesise the materials needed for the production of new virus particles. The virus, therefore, uses the host enzymes to build up new components. In order to do this the virus has to supply instructions to the cell for the new synthetic programme, and these instructions are carried by the virus nucleic acid. The nucleic acid is able to bring about not only the synthesis of more nucleic acid but also the synthesis of virus protein, and of any other necessary component. The nucleic acid, therefore, plays a key role in reproduction, and it is for this reason that much effort has gone into designing chemotherapeutic agents that will interfere with the functioning of the virus nucleic acid.

Because of the relative failure of the chemotherapeutic approach, attention has turned to the combating of viruses by immunological methods, and the success of the anti-poliomyelitis vaccine is good evidence of the effectiveness of this approach. These vaccines, however, have several disadvantages; they are costly to produce, and they are specific in their action. For example, all three types of poliomyelitis virus have to be used in vaccine production in order to give effective protection. Immunity too may be short lived, as is obvious from the transience of our own natural immunity to influenza and to the common cold.

There is another way of inhibiting virus growth, which does not involve an immunological mechanism, and that is by making use of another virus. Since virus multiplication is such a refined process, another virus may be able to interfere with the intricate cellular pathways peculiar to the infecting virus better than our own rather blunderbuss-like attacks with synthetic organic chemicals.

Virus interference

This protection by another virus through a non-immunological process is known as virus interference, and was first uniquivocally demonstrated by Findlay and MacCallum in 1937.[1] They showed that infection with Rift Valley fever virus protected monkeys from subsequent infection with the immunologically unrelated yellow fever virus. The experimental system was later simplified in two ways, first by the demonstration of virus interference in the allantoic and amniotic cavities of developing chick embryos where immunological processes cannot interfere, and second by the use of inactivated virus (*i.e.* non-infective virus) to interfere with the growth of subsequently added live virus.[2] The use of inactivated virus has a number of advantages; the complication of two viruses growing together is avoided, the inactivated virus is more inert biochemically, making it easier to find the place where the blockage of virus growth occurs, and there is no possibility of the interfering virus causing gross damage to the cell which would itself hinder the growth of the second virus, the so-called challenge virus. The amount of interference has usually been measured by a reduction in the yield of challenge virus.

The interfering virus has no effect on the challenge virus *in vitro*, but there are theoretically several ways in which an interfering virus could block the growth of another virus within the cell. It could block the uptake of virus by the cell, and this is the explanation of some types of interference. It

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Fig. 1. Normal infective virus invades a cell, goes through an eclipse phase and then produces more virus.

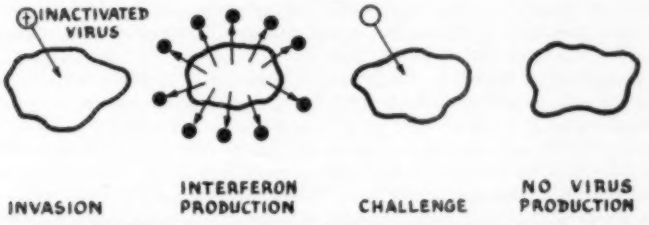

Fig. 2. When inactivated virus invades a cell interference is induced, virus multiplication cannot be supported, and interferon is produced.

might also slow down the release of complete virus particles from the cell, and some drugs appear to act in this way. However, it is clear that in the system that has been most frequently studied — interference by heat or ultra-violet inactivated influenza virus with a later infection with live influenza virus—the block is intra-cellular.[3]

There are several reasons for believing the block is intra-cellular. Several hours' incubation at 37° must elapse between the addition of the interfering virus and of the live challenge virus. Incubation at 2° or simultaneous addition of interfering and challenge viruses gives much less protection, so some metabolic action is obviously needed before the pathway of virus synthesis is blocked. The cellular pathway that is blocked must be common to a number of viruses, for inactivated influenza virus will interfere not only with influenza A and B, but also with such unrelated viruses as western equine encephalitis[4] and vaccinia.[5] Influenza virus contains ribonucleic acid, while vaccinia contains deoxyribonucleic acid, and we know that this fundamental difference in the type of nucleic acid is a reflection of a profound difference in the path of intracellular multiplication. In this case it appears that the two different types of virus nucleic acid control multiplication in the nucleus and in the cytoplasm of the cell respectively. We do not know what cellular pathways these two different types of virus have in common, and the study of viral interference must throw light on this. This type of interference—an intracellular phenomenon directed against a variety of viruses—has been called heterologous interference and appears to be mediated through a substance known as interferon.

Interferon

Interferon was discovered by Isaacs and Lindenmann in 1957 during a study of interference induced by heat-inactivated influenza virus.[6] They found that when heat-inactivated virus was incubated with the chorio-allantoic membrane from a 10-day-old chick embryo, suspended in a buffered salt solution, a substance was produced which was different from the virus and which had the property of inducing interference in fresh chorio-allantoic membranes. The situation may be represented diagrammatically as follows. In Fig. 1 normal infective virus invades a cell, goes through an eclipse phase, and then produces more virus. However, when inactivated influenza virus invades a cell (Fig. 2) interference is induced in the cell, so that it can no longer support virus multiplication and interferon is produced. When interferon is itself added to a cell (Fig. 3) interference is again induced and the cell is now unable to produce virus upon subsequent infection with live virus. The interference induced by interferon resembles that induced by inactivated virus; several hours' incubation at 37° is needed before interference is established, and interferon protects the cells of the chorio-allantoic membrane against the same wide range of viruses as does inactivated virus. The production of interferon closely parallels the induction of interference by inactivated virus. When influenza virus was inactivated by heating in a buffer at 56°C. for 1 hr. the virus would induce interference and interferon was produced. However, heating at 60°C. for 1 hr. gave an inactivated virus that would induce neither interference nor the production of interferon. Ultra-violet inactivated virus behaves similarly, for irradiation for a short period gave an interfering virus which stimulated the production of interferon. On further progressive ultra-violet irradiation the virus lost its ability to induce interference and to produce interferon at about the same point.[7] Inactivation of influenza virus with 0·02% formaldehyde gave a product which neither interfered nor stimulated the production of interferon.[8] The parallelism between the induction of interference and the production of interferon, together with their similar action on the cell, strongly suggest that the heterologous interference is mediated through interferon.

The production of interferon is not limited to the interaction between inactivated influenza virus and the chick chorio-allantoic membrane. Interferon was also produced by inactivated fowl plague virus and Newcastle disease of fowls.[8] Both these viruses are in the same general class as influenza, but there is some evidence that viruses outside this class will also stimulate interferon production. Ho and Enders[9] have found that during the growth of an avirulent chick embryo adapted poliomyelitis virus a substance appeared in the medium which had many of the properties of interferon.

It was also possible to prepare interferon from live virus under certain conditions and this was first observed by Tyrrell.[10] When live virus was incubated with chorio-allantoic membranes, virus was produced, but no interferon was produced during the first day. In the second and third days virus production slowed down and some interferon was produced.[8] It is not known whether these two phenomena are cause and effect, but it is possible that interferon, produced

by the accumulation of heat-inactivated virus, may play a part in the recovery from virus infection. Interferon was also produced in calf kidney cells and monkey kidney cells maintained in tissue culture.[8] The products obtained by these various procedures are very similar, but it is not yet known whether they are identical.

Fig. 3. When interferon is added to a cell interference is induced and the cell becomes unable to produce virus upon subsequent infection with live virus.

Mode of action

How does interferon act? Something is known about this, but much remains to be discovered. That interference is effective against two such different viruses as influenza and vaccinia suggests that the block in the viral multiplication cycle may occur at an early stage which both viruses share. This is borne out by an experiment with heat-inactivated influenza virus.[7] The virus was added to the chorio-allantoic membranes and interferon was produced. Then a second dose of inactivated virus was added and the membranes, which were unable to support viral multiplication, produced more interferon. This suggests that only part of the mechanism needed for virus synthesis is needed for the production of interferon, and it also suggests that the action of interferon is not merely a toxic one. Further information was obtained from a study of the production of interferon by ultra-violet inactivated virus.[11] It was found that while unirradiated virus did not produce any interferon within the first 24 hr., lightly irradiated virus was an efficient interferon producer. On further irradiation the virus became unable to stimulate production of interferon. Now it is known that ultra-violet light of the wavelength used (2537Å) damages the viral nucleic acid,[12] and it was suggested that this slightly damaged nucleic acid produced an analogue of some normal viral intermediate, and that this analogue was interferon. On further irradiation the nucleic acid would become too damaged to stimulate interferon production. This interferon then stopped further virus multiplication by a mechanism suggested by another experiment.[13] Interference was induced by interferon in chorio-allantoic membranes, and then 24 hr. later, live influenza virus was added. The virus did not multiply well because of the interference induced, but the membranes did produce more interferon. The situation is illustrated in Fig. 4, where interferon, which does not reproduce itself, is produced by the stimulus of live virus. It was suggested that the interferon deflected the challenge virus from production of live virus to that of interferon, thus blocking virus growth. This, of course, is only an hypothesis and poses more questions than it solves, but it is a useful basis for designing further experiments.

Properties of interferon

Interferon differs in a number of ways from the inactivated virus from which it is prepared. It does not agglutinate red blood cells, as does the virus, nor is it affected by antiserum to the virus. It also has different physico-chemical properties from the virus. It is not deposited by centrifugation at 100,000 g. for 4 hr., whereas centrifugation at 25,000 g. for 30 min. is sufficient to remove influenza virus from suspension.[14] When interferon is filtered through a series of graded collodion membranes some activity passes through a membrane with an average pore diameter of 0·048 μ,[11] whereas influenza virus is held back completely by a membrane of 0·18 μ average pore diameter.[15] This shows that interferon is smaller than influenza virus; but it is not very small, since it is non-dialysable. No information about its exact size or molecular weight has yet been obtained.

Interferon is quite stable; its activity is little changed after storage for several weeks at 0°, although the activity is destroyed by heating at 60°C. for 1 hr., or at 100°C. for 5 min.[14] It is stable over the *p*H range 2-11.[7]

Interferon has not yet been isolated in a pure state, but some chemical information has been obtained by observing the effect of various chemicals and enzymes on its biological activity. Several lines of evidence point to interferon being protein or partly protein; it is almost completely inactivated by incubation with the proteolytic enzyme, trypsin, and is completely inactivated by incubation with pepsin. It is precipitated by saturation with ammonium sulphate, and is inactivated by shaking with a mixture of amyl alcohol and chloroform, but it is only slowly inactivated by irradiation with ultra-violet light with maximal intensity at 2537 Å.[11] The enzymes attacking nucleic acids, ribonuclease and deoxyribonuclease have no effect on interferon or on the small amount of activity left after trypsin treatment, but despite this it is still possible that interferon may contain nucleic acid shielded in some way against enzymatic attack. Interferon is not affected by 0·001M sodium periodate, a reagent which attacks many carbohydrates, or by the receptor destroying enzyme from *V. cholerae*, an enzyme attacking some types of mucoproteins.[7]

There is a limit to the amount of information that these indirect methods can give, and the isolation of pure interferon is being actively pursued. The refined methods worked out for the purification of enzymes are being used, and after each fractionation procedure the product is analysed for protein to give some measure of the purification, and is tested biologically for its ability to interfere with influenza virus. The crude active solution, prepared as described below, contains about 100 μg of protein per c.c. but it is not known how much (or how little) of this is interferon. Certainly the great majority of the substances present are unwanted impurities, and the complexity of the starting material, as well as the need for continuous biological testing, make progress slow.

Production of interferon

Since relatively large amounts of interferon are needed both for chemical purification and for animal work, we tried to find optimal conditions for interferon production. Interferon was first produced by

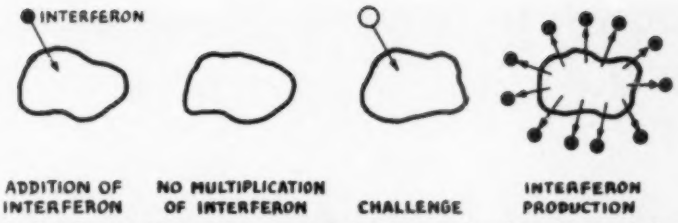

Fig. 4. Interferon, which cannot reproduce itself, is produced by the stimulation of live virus.

the interaction of heat-inactivated influenza virus with chorio-allantoic membranes, but it has long been known that ultra-violet inactivated virus is a much more efficient interfering agent, and we found it to be a more efficient producer of interferon. In contrast to the production of interferon by heat-inactivated virus, which is essentially complete within 24 hr., production of interferon from chick chorio-allantoic membranes by ultra-violet inactivated virus continues into the third day.[8] No explanation has been found for this difference. In practice it has been convenient to remove the fluid each day, and to add new buffered salt solution to prevent depletion of the medium. The amount of ultra-violet irradiation has a marked effect on the interferon yield, and the best results were obtained by using virus with the shortest period of irradiation consistent with virtually complete loss of virus infectivity. In this way it is possible to economise on the amount of inactivated virus used, and sufficient inactivated virus to prepare large quantities of interferon can be readily prepared batchwise in the laboratory. Several other types of inactivated virus have been examined, but none has been found to be such an efficient interferon producer as ultra-violet inactivated influenza virus.

A ready supply of cells is also needed for large-scale production, and the chick chorio-allantoic membrane has been used almost exclusively up to now. It supplies a large number of cells (about 10^8/egg) readily and cheaply, with only small egg to egg variation. However, it probably would not be so convenient for large-scale work; the labour involved in opening several hundred eggs would be considerable, and it would be much more difficult to handle such a large number of membranes under sterile conditions despite the use of antibiotics. It is known that interferon can be produced in monkey kidney cells, and if large-scale production were ever necessary the use of these or similar cells maintained in tissue culture might be the method of choice. The experience gained during anti-poliomyelitis vaccine production would of course be very valuable. There are a number of variables which have not been examined closely, such as the medium used, the degree of aeration and the optimum temperature, but it would not be difficult to define these. The size of the interferon molecule rules out any thought of chemical synthesis.

Before use in chemical or other studies the active solutions must be concentrated, and two methods have been used routinely in the laboratory. These are pressure dialysis (that is, dialysis with a positive pressure inside the dialysis sac) and ammonium sulphate precipitation. Neither of these methods is satisfactory for large volumes, and it may be necessary to develop another method. Pressure dialysis is inconvenient with volumes of more than a few hundred c.c., and it is difficult to remove the precipitate completely and in a sterile manner by centrifugation of large volumes of 50% ammonium sulphate.

Possible uses of interferon

It has never been possible to use viral interference as a method of combating virus infection, partly because of the toxicity of even inactivated virus particles, and partly because any protection that would be afforded would probably be only short-lived. As far as is known at the moment interferon is not toxic, but a number of other disadvantages against its chemotherapeutic use are apparent. Like the action of inactivated virus, its action is only short-lived, although we have little definite information on this point. So far it has always been necessary for it to be in the cell several hours before the virus, and this would make it less useful against established infections. Interferon is susceptible to the attack of proteolytic enzymes, and so it might be destroyed in the body before it could get to the site of virus multiplication. This would suggest that local application might be best, and it might be tried against the viruses which attack the respiratory membrane, such as colds, influenza and adeno-viruses, where the susceptible cells could be treated by spraying or painting. Unless very large amounts of interferon become readily available, systemic dosage would not be a promising route. These difficulties should warn us against undue optimism, but an attempt at chemotherapeutic use is still well worth the making.

One of the difficulties in translating interferon from the test tube to the laboratory animal is the great difference between a piece of tissue weighing 20 mg. and a mouse weighing about 20 g. This means that concentrated and also purified preparations must be used if significant answers are to be obtained in experimental animals uncomplicated by the possible effects of impurities. Interferon has been found throughout to follow closely the interfering action of inactivated influenza virus, and the difficulty with one of the obvious systems to study; influenza infection in the mouse lung is that no one has ever yet demonstrated virus interference at this site. It seems best then to eschew short cuts and to try to understand better the systems in which interference has been demonstrated. Interferon has been shown to protect against a variety of viruses in the whole egg,[16] and there is some evidence of local interference with the formation of lesions due to vaccinia virus in the rabbit skin.[7]

Whatever the outcome of these and other experiments, interferon seems important for two reasons. First, it presents a new method for attacking virus infection, and second it can give us more information about the mechanism of virus multiplication. The greater our understanding of these processes the greater our chances of being able to control the course of virus multiplication and to prevent its consequences.

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(*Concluded on page 210*)

Wellcome Complete Second Phase of £2 Million Building Programme

NEW LABORATORIES FOR VACCINE DEVELOPMENT AND MANUFACTURE

The second phase of the Wellcome Research Laboratories' £2 million expansion and development programme at Beckenham has been completed. New facilities for research on and the manufacture of virus and bacterial vaccines are now in use. The final stage of the programme is due to be completed next year. When finished the five-year scheme will have provided 180,000 sq. ft. of new laboratory space, plus the extensive modernisation and re-equipment of older buildings.

ONE of the biggest programmes of development and expansion ever undertaken by a British pharmaceutical company has been in progress since 1955 at the Wellcome Research Laboratories, Langley Court, Beckenham. The object is to provide 180,000 sq. ft. of new laboratory accommodation at a cost of £1,800,000 and the renovation and re-equipping of older buildings at a cost of £250,000. The total new investment at Beckenham is thus well over £2 million. More than half of the programme has now been completed.

First phase

The first building to go into service was the polio vaccine manufacturing unit. It was started in September 1955 and completed in January 1957 at a cost of £250,000. It is a three-storey building which provides 25,000 sq. ft. of floor area. It was designed for the production of 4 million one c.c. doses of vaccine annually and it is now working at full capacity, producing a steady flow of high-quality vaccine.

Second phase

The second phase of the scheme was started in 1957 and was completed at the end of 1958. It provides three buildings of similar design to the polio vaccine building. Two have the same dimensions and are used, respectively, for the manufacture of virus vaccines (yellow fever, canine distemper, influenza and canine hepatitis vaccines) and for research and development work on viruses of medical and veterinary importance. The latter building also houses the polio vaccine safety testing laboratory. Thus, in all, three new buildings have been built for research on and the development and production of medical and veterinary virus vaccines. The total floor area is 75,000 sq. ft. and the capital cost approximately £700,000.

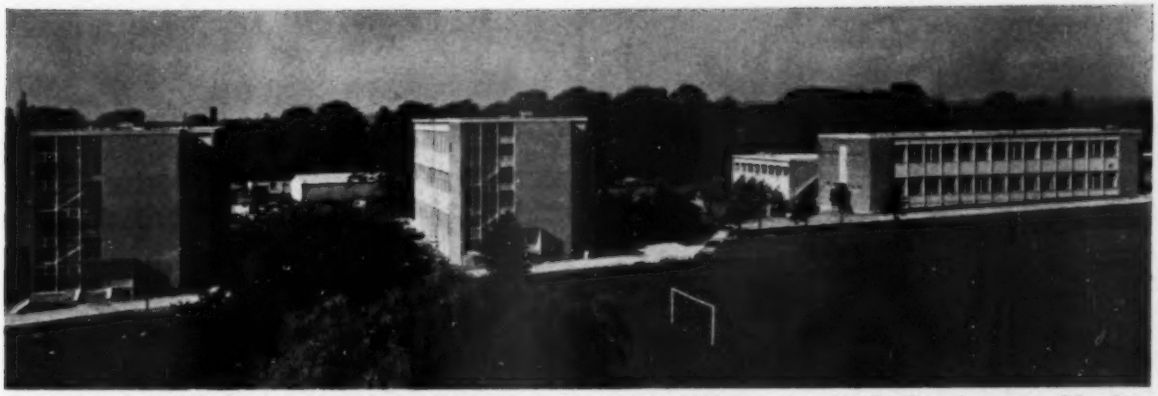
The third new building of the phase 2 development is a 30,000 sq. ft., two-storey structure for anaerobic bacteriology. Costing £300,000 to build and equip, it consists of a main double-storey building, the ground floor of which is used for vaccine production and the upper floor for research and development, with two attached wings. One provides facilities for sterilising and preparing glassware and other apparatus on the upper floor and experimental animals on the ground floor. The other provides incubator rooms and cold stores. The main work of the department of anaerobic bacteriology is research on and the development and production of vaccines designed to protect sheep against a variety of diseases, including lamb dysentery, pulpy kidney disease, black disease, blackleg, blackquarter, braxy and enterotoxaemia. These vaccines are of vital importance to the expanding sheep industry in this country, and most of them have been evolved and perfected as the result of pioneer investigations carried out at Beckenham over the past 35 years.

Third phase

The third phase of the Beckenham development plan, still in its early stages, provides for the erection of a large building for research, development and production of antisera for both human and veterinary use, and for various prophylactics, mainly for human use. This new building, the construction of which was commenced in December 1958, will have a floor area of approximately 50,000 sq. ft. and is estimated to cost some £500,000. The design of the building is essentially similar to that of the other new buildings, but an unusual feature is the provision of two large rooflit areas for the processing and refining of antisera. This building will allow for the large-scale handling of diphtheria antitoxin, tetanus antitoxin, gas gangrene antitoxin, lamb dysentery antiserum, pulpy kidney antiserum and a variety of other antisera. Provision has been made on an upper floor for the production of prophylactics for human use, including preparations for the prevention of tetanus and diphtheria and for combined prophylactics against these and other diseases, such as pertussis and poliomyelitis. The building also provides suitable premises for research and development work in these fields and for the routine standardisation and testing of the products prepared in it.

Phase 3 of the Beckenham development plan will be completed by the provision of a new home for the pharmacology laboratory. This will be provided in a new three-storey building linked with the existing chemical research laboratory. The building will provide a floor area of approximately 25,000 sq. ft. and in general design it will be similar to the three buildings erected for virus work as part of phase 2. The construction of this new building has just started.

In addition to the new buildings,



Three of the new buildings in the spacious setting of Langley Court, an estate of 110 acres about 11 miles from the centre of London. The two tall buildings, each of 25,000 sq. ft., are used for research on and the production of virus vaccines. The third building, of 30,000 sq. ft., is used for the production of anaerobic bacterial vaccines, mainly for the protection of sheep.

extensive renovation of many of the older buildings at Beckenham has been, or is being, undertaken; for example, a scheme is in progress to reclaim some 40,000 sq. ft. of space in the building erected during the war for the production of penicillin, to provide a new home for the biochemical department. This scheme is estimated to cost £125,000. When completed the five-year plan will have cost over £2 million. Many of the temporary buildings erected to meet urgent demands will be demolished and indeed some have already disappeared.

Design and construction of the new buildings

In the preparation of biological products it is essential to attain a very high standard of cleanliness, and in some cases, such as virus vaccines prepared from tissue cultures, it is necessary to provide " sterile " working conditions no less elaborate than those in the most up-to-date surgical operating theatres. There is continuous research and development on these products, and in consequence revision of the processing methods and techniques is frequently necessary. Ideally, new premises must meet exacting standards and at the same time allow of conversion for new procedures or even new functions. It is desirable to make such changes with the least possible disturbance, with the greatest possible speed and at the lowest possible cost.

Buildings of the kind under consideration require elaborate services, the commonest of which include hot and cold water, gas, electric light and power, compressed air and vacuum lines, heating, drainage, hot rooms and cold rooms and air-conditioned suites for sterile work. Such installations require a great deal of piping, ducting, wiring, etc., as well as bulky plant and equipment, and in the interests of cleanliness it is important that these services should, as far as possible, be excluded from the working laboratory areas. The basic design of the building is, therefore, of great importance, and before planning was undertaken Wellcome architects, engineers and scientists visited many of the most up-to-date laboratories in Europe and North America. No ready-made design was discovered which appeared to fulfil all the requirements, but, after several attempts, a design was evolved which, because of its unique features and general suitability for most of the new buildings to be provided, will be described in some detail.

Site considerations made it necessary to plan multi-storey buildings for most of the work to be undertaken. The most suitable form of construction appeared to be rectangular buildings with a central corridor on each floor and with staircases and lifts at either end. The only " fixed " internal structural members are a double row of columns, each 1 ft. 6 in. by 9 in. spaced at intervals along the spine of the building and incorporated in the walls of the 8 ft. wide corridor. Apart from these pillars no other internal structure is weight-bearing. The module adopted for the first building was 13 ft. 4 in., divisible into sub-modules of 3 ft. 4 in. This allows of external windows of 10 ft. width (divided into three by mullions at intervals of 3 ft. 4 in.) and separated by masonry of 3 ft. 4 in. width. With this arrangement it is possible to erect partition walls at any desired multiple of 3 ft. 4 in. In later buildings a 9 ft. module replaced the original 13 ft. 4 in. module but the basic design remained the same.

The main design problem was to provide separate space for as much of the plant and services as possible. This was achieved by reserving a " plant room " at one corner of the building, this room being continuous from the basement to the roof, like a chimney. All vertical runs of pipes, drains, etc., and much of the plant is accommodated in the plant room. Horizontal runs of pipes, drains, ducts and the like are accommodated in special service floors or voids above and below each working laboratory area. To provide this space the height between floors of the multi-storey building was standardised at 14 ft., from which space for the voids is " borrowed " from the ceiling height of rooms and corridor. By reducing the height of the central corridor to 8 ft. it is possible to create a central walkway 6 ft. in height above the corridor and to provide the remainder of the void space above the laboratories by sloping the ceiling upwards from the central walkway to the external walls. Ceiling heights of rooms rise from 9 ft. at the corridor wall to 11 ft. at the outside wall. In this way maximum window height can be obtained while the sloping ceiling reflects light. The void thus provided is in cross-section, something like the cross-section of an aeroplane, the central walkways (8 ft. wide by 6 ft. high) representing the fuselage and the wedge-shaped lateral spaces (measuring 5 ft. at the centre and

3 ft. at the outside) representing the truncated wings of the plane. In later buildings additional void space was provided by "borrowing" from cloakrooms and lavatories in which the ceiling height was reduced to 8 ft. The service void is entered directly from the stairway at the end of the building. A special feature is the incorporation of steam heating coils in the ceilings of the rooms which also form the floor of the voids.

The first building of this unique design was the polio vaccine laboratory and it proved to be so satisfactory that the design, with the modifications mentioned, was adopted for the other buildings.

This form of construction has great advantages. Nearly all plant and services are confined to separate premises (the plant room and inter-floor voids) entirely segregated from the working laboratory areas. Almost all routine maintenance and servicing can be done by the engineering staff without having to enter the clean areas and without "breaking" sterility. Services can be introduced to the laboratories at any desired point either from the void above or the void below. This enables services and drainage to be connected to any bench or table in any part of the laboratory without cutting into floors or ceilings or leaving exposed pipes, drains or wires on the floors. It is also possible to avoid horizontal runs of pipes, ducts, etc., in the laboratories, thereby simplifying the maintenance of cleanliness.

New services can be added or redundant ones removed with a minimum of disturbance in the working areas.

In the polio building many of the laboratories are supplied with "sterile" air, that is, air which has passed through a series of filters of decreasing porosity so that the air at the point of entry to the sterile areas is bacteria-free. It can be heated or cooled at will and use is made of air pressure gradients to protect the sterile areas. Seven separate air-conditioning plants have been provided to eliminate any possibility of cross-infection between sterile areas.

The "void" system also permits of the provision of forced ventilation to animal rooms and the extraction of steam from the sterilising and wash-up rooms. Similar services are provided in the other new buildings.

Nearly all plant and services in the new buildings are confined in inter-floor voids, such as this one. Almost all maintenance and servicing can be done by engineers without entering clean areas and without breaking sterility.

Background to the Beckenham Development Programme

When completed in 1960, the ambitious projects at Beckenham will consolidate Wellcome's position as the leading producers of vaccines and antisera in the British Commonwealth. Indeed, it is difficult to think of any single development of its size and type anywhere in the world.

Wellcome have been making biologicals for no less than 65 years. The first Wellcome biological—diphtheria antitoxin—was issued in 1894 and since then the company have regularly made outstanding contributions in this field. Several of their products are unique in the United Kingdom, for example, yellow fever vaccine, gas gangrene antitoxins and a number of anaerobic vaccines. The high standard of manufacture at Beckenham is convincingly demonstrated by the fact that the Laboratories are entrusted with the preparation of international standards for certain antisera.

The Wellcome Research Laboratories were moved to Langley Court, an estate of 110 acres about 11 miles from the centre of London, in 1922. The work is organised in two main divisions—the Therapeutic Research Division and the Biological Division.

Two sections of the Therapeutic Research Division—the chemical research laboratory and the pharmacology laboratory—are located at Beckenham. The third section—the Wellcome Laboratories of Tropical Medicine—is located at the main Wellcome Building in Euston Road, London.

The Therapeutic Research Division

The Therapeutic Research Division co-operates closely with the Wellcome Research Laboratories, Tuckahoe, New York, the Wellcome Veterinary Research Station at Frant, Kent, and the Wellcome Research Laboratories (East Africa). The Therapeutic Research Division has no responsibility for the manufacture of medicinal products. After the preliminary stage of research at Beckenham the development and manufacture of new products are carried out at the Wellcome Chemical Works, Dartford.

The Biological Division

The whole of the Biological Division is located at Beckenham, and in addition to research covering a wide field (including bacteriology, biochemistry, immunology and virology) the Division is responsible for the development and large-scale

Anaerobic biochemistry and routine bacteriological laboratories in one of the new buildings. Vaccine preparation demands careful testing at every stage of production.

preparation of a comprehensive series of biological products for both human and veterinary use, as well as for research into the application of these products in the treatment and prevention of disease.

Of the 1,150 employees at Beckenham, about 800 work in the Biological Division. Upwards of 50 graduate scientists are employed in the Division, including virologists, bacteriologists, immunologists, biochemists and pathologists.

The Research Director of The Wellcome Foundation, Dr. D. W. Adamson, has his headquarters at Beckenham. The Head of the Biological Division, Col. H. W. Mulligan, is the Deputy Director.

Wellcome biologicals

In the British Pharmacopœia 1958 vaccines are defined officially as "preparations of antigenic materials administered with the intention that these antigens will induce in the recipient a specific immunity to infection or intoxication by a given infecting agent." They may be said to confer active immunity by inducing the body to manufacture its own specific antibodies. They are prepared from bacteria, rickettsiæ or viruses and may be suspensions of such living organisms or extracts, derivatives or sterile suspensions of them.

Vaccines may be either simple vaccines prepared from one species of organism or mixtures of two or more simple vaccines. They are prepared in such a way as to maintain the identity of the antigen and freedom from contamination with extraneous antigens.

They comprise bacterial vaccines, viral and rickettsial vaccines, bacterial toxoids (denatured toxins) and bacterial toxins.

The official description of antitoxins is "preparations from native serum containing the antitoxic globulins or their derivatives that have the specific power of neutralising the toxins formed by a micro-organism." They are prepared by separating the serum from the blood of animals which have been immunised by injections of sterile preparations from cultures of the specific organism. Because they are docile, respond well and provide large quantities of blood, horses are normally used to manufacture antitoxins. A stud of 600 horses is maintained for this purpose, most of them at Beckenham.

The antitoxic globulins or their derivatives containing the specific immune substances may be obtained from the serum by fractional precipitation, by enzyme treatment, or by other chemical and physical methods, and the refined product is usually issued in the form of a clear liquid.

Both vaccines and antisera are packed in sterile sealed bottles or ampoules. A bacteriostatic may be added and is invariably added if the products are packed in multi-dose containers (glass bottles with rubber caps which can easily be pierced by a hypodermic syringe).

The methods of preparation of most biologicals are given in the British Pharmacopœia 1958. Notable exceptions are polio vaccine and influenza vaccine, these being so new that they have not yet found their way into the B.P.

In contrast to vaccines, antisera provide passive immunity by supplying antitoxins to specific diseases.

Where there are no contraindications, active immunity is preferable to passive immunity because it confers more durable resistance to disease. Antisera are normally used to treat developed diseases since, of course, immediate protection is achieved, whereas with vaccines there is inevitably a delay before the recipient can manufacture his own antibodies.

A number of biologicals are available both as vaccines and antisera, *e.g.* diphtheria, tetanus, lamb dysentery, pulpy kidney disease, braxy and black disease products. But there is no practicable choice in the case of, for example, polio and yellow fever.

The biologicals made at Beckenham fall under four heads:

1. *Antisera* for human and veterinary use, *e.g.* tetanus, diphtheria and gas gangrene antitoxins, and lamb dysentery and pulpy kidney vaccines.

2. *Virus vaccines.* These are of two kinds: killed vaccines such as polio and influenza vaccines, and living vaccines such as yellow fever and canine distemper vaccines. Influenza vaccine is still in the development stage.

3. *Bacterial vaccines* (*aerobic and anaerobic*). Owing to the unusually hazardous nature of the micro-organisms used, anaerobic vaccines are made in the separate building already described. Anaerobic vaccines are used exclusively against veterinary diseases.

4. *Toxoids* such as diphtheria prophylactic and tetanus toxoid.

Production problems

There are six departments in the Biological Division at Beckenham: Bacteriology, Anaerobic Bacteriology, Immunology, Virus, Biochemistry and Clinical Research. The first four carry out research development, manufacture and testing of four corresponding groups

of biologicals. The Biochemistry Department provides specialised services to other departments including toxin production, the preparation of media for all biologicals requiring them, freeze-drying facilities, etc. Only the sixth department, Clinical Research, is a non-manufacturing section.

The separation of manufacture into different departments is indicative of the specialised and often hazardous nature of the work. Anaerobic vaccines and polio vaccines are made in separate buildings, for obvious reasons. Then there are legal requirements to consider. Manufacturers of immunologicals have to obtain licences under the Therapeutic Substances Act and the Diseases of Animals Act. International regulations require that the personnel responsible for the preparation of yellow fever vaccine must not engage in any work on other viruses or bacteria for the period of preparation of the vaccine and that the premises and material used must not be used for any other purpose. Although canine distemper vaccine and yellow fever vaccine are prepared in much the same way —cultivation of the virus in chick embryo— it is necessary to segregate the premises and personnel used for the preparation of these two products.

The combination of research and manufacture is a special feature of biologicals manufacture at the Wellcome Laboratories. The work is as much an art as a science and it is essential to have top-grade supervision at each stage of production.

The basic problem is to coax micro-organisms to multiply in carefully controlled conditions and to obtain from the resulting proproducts killed or living organisms or extracts or derivatives of them.

This simplified description disguises a host of formidable technical difficulties. The growth medium (often derived from casein, horse muscle, beef, etc.) must be precisely formulated for the particular organism. That is why media preparation is centralised under highly qualified direction. It is essential to start production with organisms in the right phase of growth. Otherwise low potency products result.

After manufacture the products must be put through a complex series of extractions, refining, concentration, sterilising and blending operations. For example, antisera

Incubation of eggs used for distemper vaccine production. The eggs are of a special quality and are three times dearer than ordinary hen eggs.

for human use are purified by the "pepsin" process which includes enzyme digestion (fractionation) and chemical precipitation. The object is to get rid of the non-antitoxin-bearing proteins and produce concentrated antitoxic globulins. Veterinary products are refined by the "cresol" process which involves chemical precipitation exclusively.

Anaerobic vaccines such as pulpy kidney and black disease vaccines are prepared by propagating the specific organisms in a suitable culture medium and on completion of the growth period recovering the organisms by centrifugation and filtration. The filtrate contains the specific antigen which in such cases is a bacterial toxin. The latter is rendered harmless by treatment with formalin which converts the toxin to toxoid.

In all cases finished biologicals or products awaiting blending are stored in cold rooms at 4°C.

Plant

Most products are prepared in glass bottles of up to 15-litres capacity. The advantages are two-fold: the product can be readily seen at all stages of preparation and the limitation of bottle size minimises losses should contamination occur. On the other hand, the production of batches of up to 600 litres in 15-litre flasks creates handling difficulties. At Beckenham the bottles are stacked on metal racks so that batches can be moved by fork-lift truck. But it would clearly be an advantage to use much larger vessels for culturing and experiments are in progress with 300-litre glass-lined steel vessels. These are steam-jacketed so that in effect they are self-sterilising, thus obviating the need for putting large numbers of flasks through autoclaves. With large vessels provision must also be made for degassing the broth, to remove the metabolic products of the growing organisms.

The chief disadvantage of using large vessels is that should contamination occur a large and expensive batch would have to be discarded.

Assay

Superimposed on all the other problems of manufacture is the overriding need to check for potency, sterility and absence of toxicity at various stages of manufacture. It is impossible to do this by chemical assay, so a variety of biological tests is employed. They are laid down in the British Pharmacopœia and the British Veterinary Codex and range from tests against isolated micro-organisms *in vitro* to tests in living animals. For example, the potency test for canine distemper vaccine is its ability to protect ferrets against infection with virulent distemper virus. Yellow fever vaccine is tested for potency in mice. Antitoxins are tested for absence of toxicity by injecting samples into small laboratory animals.

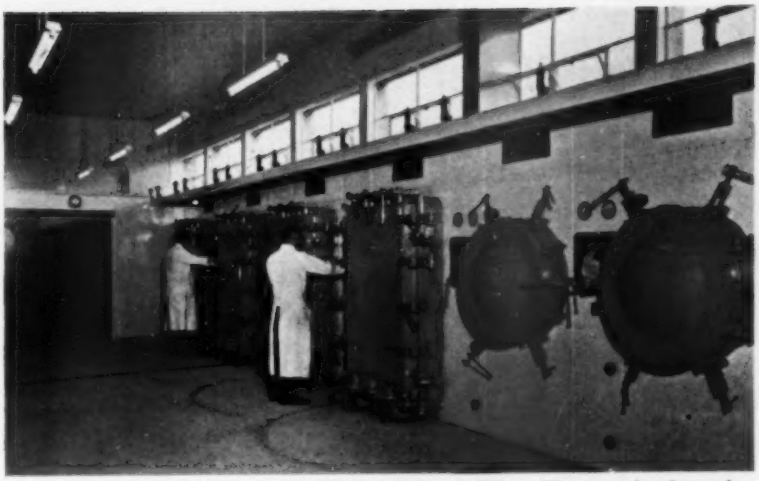
Most assays are prescribed by law. All are expensive. The assay of a single batch of poliomyelitis vaccine can take two months and cost £5,000.

Because assay is expensive, products are made in the largest possible batches. Polio vaccine was originally made in 150-litre batches; now it is made in 600-litre batches.

Every batch is tested by the Medical Research Council as well as by the manufacturer, so the need for larger batches and consequent economies in assay costs was doubly pressing. However, the bigger the batch size the bigger is the loss should the batch prove to be unsatisfactory.

Packaging

All biologicals are issued in sterile sealed glass containers. Some are suspended in saline solution (*e.g.* typhoid vaccine), others are freeze-



A bank of autoclaves in the anaerobic bacteriology building. The extra headroom has been provided in case at some future date it is necessary to install plant requiring this space.

dried solids (*e.g.* yellow fever vaccine), the diluting fluid being supplied in separate ampoules. A prescribed percentage of all filled containers are tested as a final check on sterility.

The withdrawal of samples for tests plus filling losses can cut the number of doses obtained from a batch by as much as 8% compared with the original quantity. For example, a 600-litre batch of polio vaccine yields no more than 550,000 doses (of 1 c.c.).

* * *

This brief outline of biological product manufacture can only hint at the complexity of apparently simple processes. Perhaps more than any other branch of pharmaceutical manufacture it depends heavily upon first-class scientific supervision based upon a massive foundation of accumulated experience. The Wellcome Research Laboratories are fortunate in having a very long tradition in this exacting branch of pharmaceutics. The know-how possessed by their scientists and technicians, a number of whom have been at Beckenham for 30 years and more, in combination with the unsurpassed facilities now provided by the new buildings and equipment, will assuredly raise the company's reputation to still greater heights in a field in which they already have a distinguished record.

Services and equipment for Burroughs Wellcome's new laboratories at Beckenham were supplied by the following contractors:

Metal windows:
Henry Hope and Sons Ltd.
Flexiмer flooring:
Semtex Ltd.
Asphalt and felt roofing:
Limmer and Trinidad Lake Asphalt Co. Ltd.,
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ANILERIDINE

This is a new analgesic reputed to have one-third the activity of morphine. According to the *B.M.J.* (1959, (5119), 430), tolerance to anileridine develops more slowly than with morphine or pethidine, euphoria is uncommon and addiction has not yet been observed. Withdrawal symptoms were not seen even in a patient who had had 552 doses.

The molecule of pethidine contains an $=N-Ch_3$ group, which is believed to be important for the degree of activity. In anileridine, the $-CH_3$ group is substituted by phenylethyl, and then an $-NH_2$ group is introduced into the ring.

Technical Press Review—May

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Cosmetic Science Discussed at London Congress

By Wm. W. Myddleton, D.Sc.

The first British Congress of Cosmetic Science was held at University College, London, on April 16 and 17. The total registration exceeded 270 and the international importance of the event was indicated by the presence of representatives of 13 overseas countries.

The chairmen at the four sessions of the Congress were Dr. Max Stoll (Switzerland), Mr. M. G. de Navarre (U.S.A.), Dr. H. Heinrich (U.S.A.) deputising for Mr. S. J. Strianse (U.S.A.), and Dr. H. Hibbott (U.K.).

The first report on the Congress appeared in our April issue.

FROM the keen and lengthy discussions which followed each paper it is possible to single out for comment only matters of outstanding interest to the industry as a whole.

Laboratory mechanisation

The mechanisation of laboratory apparatus was discussed by Mr. R. Barrington Brock and the range of measurements which might be made automatic was surveyed in the subsequent comments. Some operations were difficult to mechanise, and if it were found possible the apparatus would be costly. In reply to a question Mr. Barrington Brock said that the determination of particle size by the permeability method might well fall into this category because of the difficulty of securing the uniform packing of the powder bed. Moisture content would be an important factor in the packing.

Another questioner suggested that another form of mechanisation worth considering would be the linking of simple units to form a multifunctional unit, *e.g.* a motor to provide infinitely variable speeds of rotation in either a vertical or a horizontal plane. The lecturer said this was quite possible with existing equipment, but that the cost rose steeply if a very wide range of speeds was required.

A questioner doubted that large savings would be achieved by a high degree of mechanisation because maintenance and repairs would be expensive, particularly when electronic circuits failed to behave.

Mr. Barrington Brock pointed out that no automatic unit should be approved until it was certain that in the event of a breakdown the mechanism would cease to operate, instead of turning out false results. The unit should be so constructed that all vital parts could be replaced simply and quickly in the event of a breakdown.

The crossing-over of unlike antigens, an illustration from Dr. Feinberg's paper.

Another contributor to the discussion suggested that in order to study the possibilities offered to the cosmetic laboratory by automation and to consult manufacturers on apparatus and the desirable extent of mechanisation, the cosmetic industry should set up a committee or, better still, a scientific section to advise on these matters. Such a body could buy and keep in operation such costly apparatus as could be operated at a central research station and would provide expert staff to keep the operation as continuous as possible.

Panel testing

In the second session two papers dealing with panel and consumer testing of cosmetic products produced suggestions for overcoming some big difficulties in the way of obtaining reliable answers. It was thought that the strong influence of favoured persons taking part in panel tests could be overcome by submitting the results to statistical treatment. The strong voting factor of non-essentials—*e.g.* colour and odour in some products could only be discovered by re-testing after an interval. Fashions and prejudices in such things varied and if a firm decided to try a change it might catch the current public fancy and romp ahead of competition.

Dermatological action

Dr. E. J. Moynahan of the Dermatological Department of Guy's Hospital emphasised the difference between the action of an irritant and a sensitiser. With sensitisers it was rare to find the more severe reactions which followed contact with a primary irritant. The primary irritant produced reaction precisely at the site of application, but the sensitiser sooner or later showed a spread of reaction beyond this area. Again, repeated application of a primary irritant to the same site produced similar results so long as the concentration and duration of application were kept constant, but the sensitiser would produce increasingly severe reaction at each additional application. It might be some time before a sensitiser began to produce a skin reaction and moreover a sensitiser might cause an immediate reaction when the subject was brought into contact with a second substance for the first time. For example a patient sensitised to the drug Phenergan had a sensitivity towards the dye *p*-phenylenediamine without having been in contact with the dye. The structural formula of the drug was more complicated than that of the dye and it was assumed that the drug was metabolised in the body

During the Congress delegates from eight countries met in the rooms of the Chemical Society to discuss the formation of an International Federation of Societies of Cosmetic Chemists which would link together the various autonomous national societies. Agreement was reached on provisional constitution, and a provisional secretariat was set up at 2, Lovers' Walk, London, N.3. From left to right the delegates are:
Sitting: *Mr. G. Dony (Belgium), Mr. S. Strianse (U.S.A.), Mr. J. B. Wilkinson (Great Britain), Mr. M. G. deNavarre (U.S.A.), Dr. R. H. Marriott (Great Britain), Mr. Erik Thomsen (Denmark), Mr. J. W. Middlemiss, Mr. T. Lyddon Gardner, Mrs. E. Millman, Mr. G. Dumont (Belgium).*
Standing: *Mr. T. G. C. Hendy, Mr. R. A. Kramer (U.S.A.), Mr. Bjarne E. Borud (Norway), Mr. C. A. Williams, Dr. L.-W. Masch (Germany), Mr. P. Vélon (France), Mr. D. Budgett-Meakin, Mr. R. G. Dyas.*

and broken down to a smaller molecule akin to that of the dye. The dye did not bring about sensitivity to the drug.

It would appear that this cross-sensitisation, as it was called, was most important in such widely used substances as cosmetics. There was always the possibility of causing cross-sensitivity with a life-saving antibiotic or other remedial agent in the event of future illness requiring such remedies. The risk in the case of cosmetics was small but might become significant if therapeutic substances were incorporated in the product.

Allergy

Dr. J. G. Feinberg described two interesting techniques for investigating relationships between sensitising substances, illustrating the subject with lantern slides. The writer is grateful to Dr. Feinberg for the following account of the techniques and for the photograph to illustrate one of them.

The tools of immunology can be used to study the relationships between sensitising substances. Where these substances are macromolecules—*i.e.* proteins or polysaccharides—direct tests can be carried out. Where they are simple chemical substances indirect tests—in the form of chemical attachment to a macromolecule — are generally necessary.

One immunological technique used to study antigens and their relationships is immune precipitation in agar gel plates. When the blood serum of an immunised rabbit is allowed to diffuse from a hole in an agar slab and, simultaneously, a solution of the immunising substance is allowed to diffuse from a nearby hole, a band of precipitate will form between the two. If several antigens and antibodies are involved, they will usually show up as a series of individual bands.

If two different antigen solutions are diffused from separate holes against one antiserum in a third hole, precipitation bands which form at the respective antigen holes will extend and coalesce, if similar antigens are involved; but cross over and continue in their respective directions if unlike antigens are present. The crossing-over of unlike antigen bands is strikingly observed when four holes are arranged in the agar at the corners of a square and each antigen-antiserum pair is distributed between diagonal holes. (See illustration.)

This type of investigation can be translated to the living animal, using the skin of the guinea-pig as the reaction milieu in place of the agar slab. The antisera to be investigated are injected in suitable dilutions into the skin of a guinea-pig. After 4 to 24 hr., allowing time for the antibodies to fix in and sensitise the skin at the injection sites, the animal is given an intravenous injection of a harmless blue dye and one of the test antigens. At those sites where the injected antisera contained antibodies which could react with the antigen a combination between the two takes place. This causes a release of histamine, which increases the permeability of the capillaries in the area and allows the blood serum proteins, to which the blue dye has attached itself, to leak out into the skin. Thus, the appearance of blue spots in the skin indicates which antisera were able to react with the antigen. Antisera made against the injected antigen will always react, but antisera to other antigenic substances will only do so when there is a chemical kinship to the injected antigen.

A more direct test of actual cross-sensitisation can be carried out by actively sensitising guinea-pigs to individual antigens. After three weeks the antibodies produced by the sensitising injection will have fixed in the skin. Again using a blue dye intravenously, different antigens can be injected into the skin and checked for their ability to elicit the blue-spot reaction. Where antigens other than the original sensitising antigen produce such blue spots it is an indication that the respective antigens are chemically related.

So far these methods have not received much attention in the study of cosmetic sensitivities. Indeed, they may offer certain difficulties in their application to cosmetic sensitisation studies. But these should not be insurmountable.

Classification of substances as sensitisers

In the original paper presented by Dr. Feinberg, Table I giving a list of cosmetic materials regarded as sensitisers and, therefore, omitted from the so-called hypo-allergenic cosmetics, came in for criticism. The item almond oil was declared by one speaker to be the essential oil known in this country as oil of bitter almonds and not the fixed

(Concluded on page 216)

2-Vinylpyridine-

VERSATILE INTERMEDIATE

By E. R. Wallsgrove*

Only recently has 2-vinylpyridine been manufactured on a commercial scale in Britain. The diversity of its reactions and the novel properties of products obtained from it suggest that it may find a wide variety of applications in the manufacture of plastics, pharmaceuticals, disinfectants, pest control products, dyestuffs, wetting agents, corrosion inhibitors, ion exchange resins, etc. In this article the author lays emphasis on the reactivity of 2-vinylpyridine and outlines its potentialities as an intermediate, and particularly its ability to introduce new properties into polymers.

THERE are two principal routes to 2-vinylpyridine. One is to condense 2-picoline and formaldehyde under pressure to give 2-(2-pyridyl)-ethanol, which is then dehydrated either by distillation from caustic alkali[1] or by vapour phase dehydration over alumina[2]. The alternative method is by catalytic vapour phase dehydrogenation of 2-ethylpyridine.[3]

A recent patent describes the production of 2-vinylpyridine in a single stage from 2-picoline by reacting it with formaldehyde in the vapour phase over a zinc fluoride catalyst.[4]

Physical properties

The values given in the literature for the boiling point of 2-vinylpyridine are somewhat conflicting. Because of the readiness with which 2-vinylpyridine polymerises on heating, it is usually distilled under reduced pressure, preferably at 50 mm. or below.

b.p. °C.	pressure mm. Hg
159	760
110	150
98	100
80	50
60	17

n_D^{20} 1·5518

d_4^{20} 0·9770

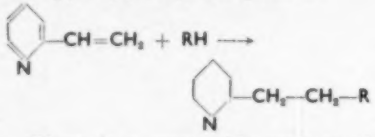
picrate	m.p. 157-158°
chloroaurate	m.p. 143-144°
chloroplatinate	m.p. 174-5°
β-resorcyclic acid salt	m.p. 113°

2-vinylpyridine is soluble in water to the extent of 2·75 g./100 g. water at 20°, while the solubility of water in 2-vinylpyridine is 18·8 g./100 g. at 20°. It is soluble in dilute acids and in all common organic solvents. It has a pungent odour and has lachrymatory properties.

* Chief Research Chemist, Midland Tar Distillers Ltd.

Chemical reactions

As a result of its conjugation with the pyridine ring, the double bond in 2-vinylpyridine has a powerful electrophilic character and its reactivity closely resembles that of acrylonitrile. 2-Vinylpyridine reacts readily with nucleophilic active hydrogen compounds to give 2-(2-pyridyl)-ethyl compounds:



There is a very wide variety of nucleophilic reagents which will react in this way with 2-vinylpyridine, offering considerable scope for using 2-vinylpyridine as an organic intermediate. A number of these reactions are described below.

A further consequence of the activation of the double bond is the ease with which 2-vinylpyridine polymerises and copolymerises with a large number of other unsaturated substances.

Catalytic hydrogenation, using either Adams platinum catalyst or Raney nickel, yields 2-ethylpyridine,[5] which can be reduced further to 2-ethylpiperidine. Oxidation of 2-vinylpyridine gives picolinic acid.

Hydrogen cyanide,[6] sulphurous acid[7] and nitrous acid[8] add readily to the vinylpyridine double bond to give, in good yield, 2-(2-pyridyl)-propionitrile, 2-(2-pyridyl) ethane sulphonic acid and 1-nitro-2-(2-pyridyl) ethane respectively. Sulphinic acids[9] react to give sulphones; hydrazoic acid[10] and ethyl diazoacetate[11] react to give 1-(2-pyridyl)-2-azidoethane and the ethyl ester of 2-(2-pyridyl)-cyclopropane carboxylic acid respectively.

2-(2-aminoethyl) pyridine is obtained very readily from 2-vinylpyridine and ammonia[12] (as an aqueous methanolic solution of ammonium chloride). A large number of ammonia derivatives will react similarly—primary and secondary amines (aliphatic, aromatic and heterocyclic)[13] amides[12] and imides.[14] A very wide variety of amines (even such weakly basic ones as pyrrole) will undergo this addition reaction which in many cases will proceed uncatalysed but in other cases requires catalysis by acetic acid, hydrogen chloride or sodium.

2 - [2 - (phthalimido) - ethyl]-pyridine, from 2-vinylpyridine and phthalimide, is useful for producing mild analgesia, and the addition product of methylamine and 2-vinylpyridine, 2 - [2 - (methylamino) - ethyl] - pyridine, is useful for lowering blood pressure.

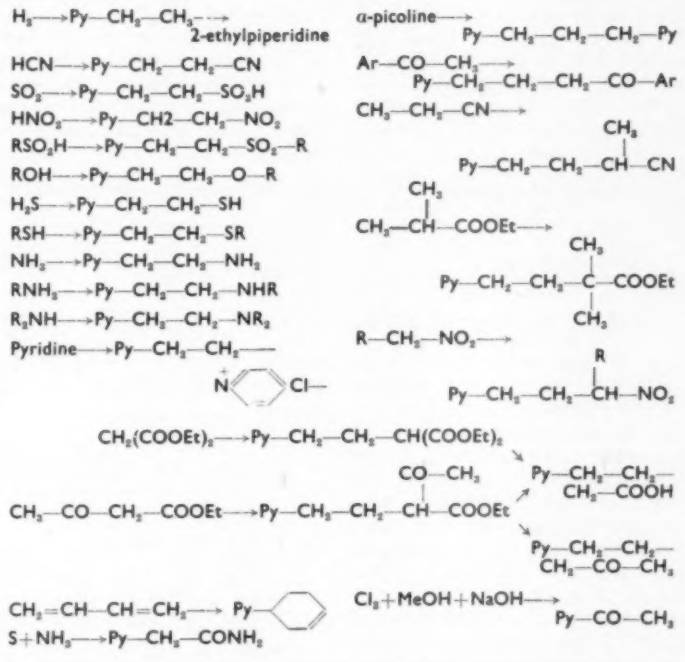
2-Vinylpyridine will even react with the tertiary amines pyridine, quinoline and isoquinoline to give quaternary salts: for example, with pyridine hydrochloride in pyridine the product is 1-[2-(2-pyridyl)-ethyl] pyridinium chloride.[15]

With pyridine or quinoline homologues containing reactive alkyl groups, for example methyl or ethyl groups, in the 2, 4 or 6 position, reaction occurs readily in the presence of sodium to give dipicolylmethanes, *e.g.* 2-picoline gives di-2-picolylmethane.[16]

Ketones,[17] nitriles,[18] esters,[19] β-ketoesters,[6, 20] β-diketones,[20] malonic esters[6, 20, 21] and nitroparaffins[22] undergo a Michael condensation reaction with 2-vinylpyridine in the presence of sodium, sodium ethoxide, Triton B or even hydrogen chloride to give 2-pyridylethyl compounds in good yield;

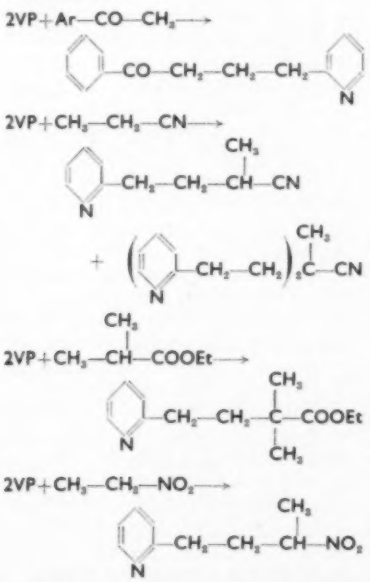
REACTIONS OF 2-VINYLPYRIDINE

py = 2-pyridyl

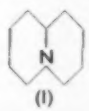


dipyridylethylation can also occur.

Illustrative examples of this reaction are:



Malonic ester gives diethyl β-(2-pyridyl)ethyl malonate which can be hydrolysed to give γ-(2-pyridyl) butyric acid; this can be reduced with lithium aluminium hydride to 4 - (2 - pyridyl) - butanol - 1.[21] Reductive cyclisation, using hydrogen and a copper chromite catalyst, of the malonic ester condensation product gives quinoloxidine (I) in good yield.[20, 23]



(I)

Acetoacetic ester gives ethyl β-(2-pyridyl)ethyl acetoacetate; this, according to whether acid or alkaline hydrolysis is used, gives 1-(2-pyridyl)-pentanone-4 or γ-(2-pyridyl)-butyric acid.[6]

Ethanol will add on to the double bond of 2-vinyl pyridine in the presence of sodium ethoxide to give ethyl 2-(2-pyridyl)ethyl ether.[6] A wide variety of other alcohols will react similarly.[24]

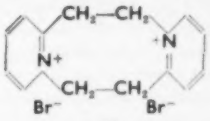
Many thiol compounds react readily with 2-vinylpyridine, including hydrogen sulphide,[25] methyl and ethyl mercaptans,[9, 25, 26] thiophenols[27] and thiolacetic acid.[28] Hydrogen sulphide gives 2-(2-pyridyl)-ethanethiol and 2-(2-pyridyl)-ethyl sulphide.

Whilst in the presence of polymerisation catalysts, butadiene and other 1 : 3-dienes can be copolymerised with 2-vinylpyridine, the activation of the double bond in 2-vinylpyridine is such that the Diels-Alder reaction occurs readily on heating the two together without catalyst.[29]

Butadiene, for example, gives 2 - (3 - cyclohexen - 1 - yl) pyridine, which can be dehydrogenated to give 2-phenylpyridine or reduced to 2-cyclohexyl-pyridine.

2-Vinylpyridine also undergoes the Willgerodt and Meerwein reactions. On heating with sulphur and ammonia in dioxan or pyridine solution 2-pyridylacetamide is obtained.[30] Aryl diazonium chlorides react with 2-vinylpyridine to give stilbazoles—*e.g.* *p*-chlorobenzene diazonium chloride gives 4′-chlorostilbazole.[31]

Treatment of 2-vinylpyridine with chlorine and methanol gives α-methoxy-β-chloro-2-ethylpyridine which can be hydrolysed to give 2 - acetopyridine.[32] Heating 2-vinylpyridine hydrobromide gives 3 : 4 : 7 : 8-tetrahydrodibenzo (a,e) -1 : 5-diazocinium dibromide (II).[33]



(II)

2-Vinylpyridine N-oxide can be prepared in good yield by oxidising 2-(2-pyridyl)ethanol with hydrogen peroxide and acetic acid to the corresponding N-oxide and then dehydrating this to 2-vinylpyridine N-oxide.[34] This will add on alcohols, amines, mercaptans, etc., in the same way as 2-vinylpyridine and can be polymerised or copolymerised with styrene, butadiene, acrylonitrile, etc.

Polymerisation and copolymerisation

2 - Vinylpyridine polymerises slowly on standing at room temperature and much more readily on heating. Because of this it is necessary to store 2-vinylpyridine in the presence of a polymerisation inhibitor and when distilling it to use as low a pressure as practicable.

High molecular weight polymers can be obtained by bulk, solution, emulsion or suspension polymerisation. A wider variety of polymerisation catalysts may be used—*e.g.* irradiation with ultra-violet light, benzoyl peroxide, azodiisobutyro-

nitrile, Redox systems, etc. Vinylpyridine may be polymerised not only in solution in an organic solvent but in aqueous mineral acid solution.[35]

One patent claims that treatment of 2-vinylpyridine with chloracetic acid leads to polymerisation to give a polymeric quaternary pyridinium salt with evolution of carbon dioxide.[36]

Poly-2-vinylpyridine may be catalytically hydrogenated to give poly-2-vinylpiperidine.[37]

2-Vinylpyridine can readily be copolymerised with a wide variety of vinyl compounds and dienes, *e.g.* butadiene,[38] isoprene,[39] chloroprene,[40] styrene,[41] acrylonitrile,[42] vinyl acetate,[43] methacrylic acid,[44] ethyl acrylate.[45] A number of ternary copolymers featuring 2-vinylpyridine as one ingredient have been prepared.[46]

The various types of polymeric product find use in synthetic rubbers, fibres, ion-exchange resins, photographic compositions, polyelectrolytes, etc., which will be discussed in more detail later.

The particular virtues in introducing vinylpyridine into a polymer molecule lie mainly in the novel effects which can be obtained by the presence of the basic nitrogen atom. Quaternisation with alkyl halides, dialkyl sulphates or *p*-toluene sulphonic esters leads to oil-insolubility and promotes water solubility. Quaternisation with a dihalogen compound such as ethylene dichloride leads to cross-linking. Reaction with chloroacetic or bromoacetic acid (or their esters followed by hydrolysis) enables a polymeric betaine to be produced.

Polymers of unusual and distinctive properties are obtained by copolymerising 2-vinylpyridine with an acidic monomer such as acrylic acid, methacrylic acid or vinyl sulphonic acid. Such polymers contain both ionisable acidic and basic groups and are amphoteric ("polyampholytes").

Elastomers consisting of butadiene/2-vinylpyridine copolymers or butadiene/styrene/2-vinylpyridine have virtues as synthetic rubbers because of improved oil resistance and low temperature flexibility.[47] Again in the rubber field 2-vinylpyrindine/butadiene copolymers with phenol/formaldehyde resins have outstanding properties as tyre-cord adhesives.[48]

Other rubber applications are the manufacture of golf ball covers,[49] a resin to protect rubber surfaces from deterioration caused by ozone[50] and improvement in the physical and chemical properties of Thiokol sealing compounds.[51]

Copolymers of acrylonitrile and 2-vinylpyridine can be spun into fibres which have the advantage of being readily dyeable with acid dyes.[52] Vinyl acetate, methyl acrylate and other vinyl compounds can also be incorporated as a third component of the fibre-forming polymer. Usually less than 5% of vinylpyridine is needed to give to the acrylonitrile polymer ready dyeability. There are other textile applications for products from 2-vinylpyridine claimed in the patent literature. Quaternary salts of poly-2-vinylpyridine are useful as mordants for acid dyes,[53] and addition of poly-2-vinylpyridine to acid dye baths facilitates the dyeing of acrylonitrile polymers.[54] Three patents describe the use of 2-vinylpyridine polymers or copolymers to impart water repellency and flame proofedness to wool, cotton, silk, rayon and linen fabrics.[55] The addition of a 2-vinylpyridine polymer increases the resistance of cellulose ester fibres dyed with disperse dyestuffs to gas-fading.[56]

The basic properties of vinylpyridine and the readiness with which it can be copolymerised with other monomers has led to a number of patents on its use in the production of ion-exchange resins. Ion exchange properties are claimed for polymers of 2-vinylpyridine with cyclopentadiene,[57] divinylacetylene[58] or vinylketones.[59] Cross-linking of vinylpyridine copolymers may be achieved by incorporating divinyl-benzene or 2 : 6-divinylpyridine. The polymers may be quaternised and then converted to the hydroxide form. The products are useful as acid-absorbing resins and anion-exchange resins.[60] The same methods can be used to produce infusible, insoluble, electrically conductive, anion-permeable membranes for use in electrodialysis.[61]

There is a considerable number of patents on the use of vinylpyridine polymers in photographic film applications.[62]

The various types of polyelectrolyte which can be obtained from 2-vinylpyridine have been the subject of a considerable number of academic studies as well as having been suggested for a number of commercial applications.[63] These polyelectrolytes are electrically-conducting solid polymers.

A number of other uses for resins containing vinylpyridine are described in the patent literature. These include the production of high wet strength paper,[64] the production of laminated weatherproof sheets for building purposes[65] and emulsifying and demulsifying agents.[66] Many other plastic compositions for various uses and which incorporate 2 - vinylpyridine are described.[67] Uses for derivatives of 2-vinylpyridine to be found in the literature include dyestuffs intermediates, pesticides (fungicides, insecticides, bactericides and herbicides), disinfecting and sterilising agents, curing agents for epoxy-resins, wetting agents, corrosion inhibitors, photographic chemicals and pharmaceuticals.

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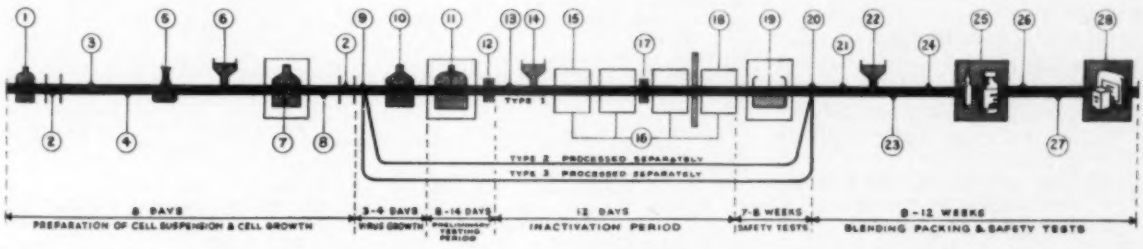
(Concluded on page 210)

The Complex Process of Making and Testing Polio Vaccine

(1) MONKEY KIDNEYS FROM THEATRE TO STERILE AREA
(2) ULTRA-VIOLET LOCKS
(3) KIDNEY TISSUE CUT INTO SMALL PIECES
(4) CHOPPED TISSUE BROKEN DOWN
(5) CELL SUSPENSION TESTED FOR STERILITY
(6) COMPLEX FEEDING SOLUTION (MEDIUM) ADDED
(7) CELLS GROWING IN INCUBATOR
(15) SAMPLES TAKEN TO SHOW RATE OF KILLING OF POLIOVIRUS
(16) FLUID TRANSFERRED TO FRESH VESSEL IN FRESH INCUBATOR EVERY 3 DAYS
(17) VIRUS FLUID FILTERED AGAIN ON SIXTH DAY OF INACTIVATION
(18) SAFETY TESTS
(19) KILLED VIRUS FLUID STORED IN COLD ROOM UNTIL TESTS COMPLETED
(20) THREE TYPES BLENDED AND FORMALIN-NEUTRALIZED
(21) SAMPLE TAKEN FOR FURTHER SAFETY TESTS BY MANUFACTURER AND M.R.C.



(8) OLD MEDIUM REPLACED BY NEW ONE
(9) LIVE POLIOVIRUS ADDED
(10) VIRUS MULTIPLIES IN LIVING CELLS AND DESTROYS THEM
(11) FLUID CONTAINING VIRUS STORED IN COLD ROOM
(12) VIRUS FLUID FILTERED
(13) SAMPLE TAKEN TO CHECK AMOUNT OF VIRUS PRESENT
(14) FORMALIN ADDED TO KILL VIRUS
(22) PRESERVATIVE ADDED
(23) FILLING OF AMPOULES AND VIALS
(24) SAMPLES OF FILLED MATERIAL TESTED BY M.R.C. AND MANUFACTURER FOR SAFETY AND POTENCY
(25) AMPOULE (1 DOSE) AND VIAL (10 DOSES) OF FINISHED VACCINE
(26) FINAL STERILITY TEST BY MANUFACTURER
(27) EACH CONTAINER INSPECTED BEFORE PACKING
(28) PACKAGED VACCINE STORED IN COLD ROOM UNTIL RELEASE

[*Courtesy Pfizer Ltd.*

THE campaign of the Ministry of Health to encourage eligible persons to accept polio vaccination has been dramatised by the death from polio of a popular footballer. The ensuing rush for vaccination has heavily depleted stocks of vaccine and the three manufacturers — Burroughs Wellcome, Glaxo and Pfizer—are hard at work making fresh supplies.

As can be seen from the above flowsheet, the manufacture and, in particular, the testing of vaccine is complex and takes 20 to 24 weeks to complete. Of this period manufacture takes only 3½ to 4 weeks and testing the remainder. The flowsheet and the following details of production and testing have been supplied by Pfizer Ltd., whose new plant at Sandwich, Kent, is now producing at the rate of a million doses a month.

The numbering of the following paragraphs is not intended to correspond with the stages numbered in the flowsheet.

1. A suspension of kidney cells is made by breaking down tissue taken from kidneys of healthy monkeys into individual cells with the enzyme trypsin.

2. The suspension is seeded into flat-sided bottles together with a complex nutrient medium to keep the cells alive and the bottles are incubated at 37°C. (body temperature) for about a week. About 80% of the cells die but the remainder multiply and form a united sheet over the inner surface of the bottle.

3. The nutrient medium is then removed, the cells washed and fresh medium containing only defined chemical substances is substituted.

4. The bottles are now inoculated with a small volume (about 2 c.c.), containing some 2 million virus particles of one type of virus.

5. The bottles are incubated again to allow the virus to multiply in the cultured kidney tissue cells. When this phase is complete, in about two to three days, the kidney tissue cells killed by the multiplying virus become detached from the glass and sink to the bottom, leaving a fluid rich in living virus many times greater than the initial concentration. In fact there are about 10^{-8} virus particles per ml.

6. The fluid is harvested, the contents of a number of bottles being combined to form a Monovalent (single strain) virus "pool" of suitable size.

7. Tests are carried out to confirm that only the polio virus with which the suspension was inoculated is present; to estimate the amount of virus present; and steps taken to exclude other viruses and bacteria by sterility tests.

8. Inactivation (rendering the virus incapable of giving rise to the disease) of the live virus in the "pool" by formalin (diluted formaldehyde) is now carried out. This is a critical stage of the whole process of manufacture calling for the utmost vigilance and frequently repeated tests. While the virus must be prevented from giving rise to paralysis, it must still be capable of promoting antibody production.

The Monovalent "pool" is now incubated at body temperature for twelve days. The reaction between virus and formalin is completed in about six days, and an additional six-day period gives a further safety measure.

The chances of a virus particle escaping contact with formalin are very small. By ingenious mechanical devices, the "pool" is stirred or shaken to ensure contact between every virus particle and the formalin. During the 12-day incubation period, the mixture is transferred to fresh containers in a separate room by means of a narrow tube through a wall. This last procedure is repeated several times. The narrowness of the tube is an additional insurance that every particle of virus comes into contact with the formalin.

Test samples are examined at frequent intervals in suitable tissue cultures. If live virus were present, it would multiply and become discernible to the careful scrutiny of the experts. If there were any shadow of doubt, the whole batch would be discarded.

The process described is repeated for all three main types of polio virus, namely Type 1 (Brunenders), type 2 (M.E.F.I.) and type 3

(Saukett). When the three separate virus "pools" have successfully passed all required tests, they are mixed in roughly equal quantities.

The vaccine is now a Trivalent vaccine, *i.e.* contains the three types of polio virus known to cause paralysis.

Searching tests are now repeated to ensure that:

(*a*) No particle of live virus remains;
(*b*) No virus of any other kind is present as a contaminant;
(*c*) No bacteria, yeast, etc., are present;
(*d*) The potency of the vaccine (its ability to produce antibodies) is adequate.

If all these tests prove successful, the completed batch of trivalent vaccine, together with the protocol (the complete dossier relating to the production and testing of the batch) is sent to the National Institute for Medical Research, where the stringent tests are repeated.

Only when the N.I.M.R. gives the batch a "clean bill" is the vaccine released for use.

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FERTILISERS and Plant Nutrients

By D. P. Hopkins, B.SC., F.R.I.C.

FAO survey • Phosphate • Sulphur use • Molybdenum benefits • Complex or compound fertilisers? • Market for compound fertilisers

World survey of fertilisers

THE latest review of world fertiliser production and consumption from FAO[1] shows that 1956-57 production was 8% above the preceding year, and 1956-57 consumption was 11% higher. For 1957-58, estimated figures indicate a conservative 3% expansion for both production and consumption. Separately the three main fertiliser nutrients (N, P and K) show differing trends. Thus, in the two years stated above, nitrogen production expanded by 8 and 9% but there were sharp falls in estimated 1957-58 production of P and K, the former's rate of expansion dropping to a rate of 1% and the latter's production being forecast as an actual contraction of 1%. Expansion, therefore, is confined to nitrogen. With phosphatic fertilisers, the most reliable guess is probably a slight expansion. The estimated slight drop in potash output is not, however, an indication of falling use; rather, it is a reflection of over-production in preceding years and a tendency to reduce stocks held.

A breakdown of world data shows that much of the current expansion is occurring in countries that have long been low users of fertilisers. In very few countries where higher rates of use are established has there been much expansion; in some of them there have been small but definite contractions. Europe is still the largest continental user, consuming in 1957-58 45% of world N, 50% of world P, and 64% of world K. Europe's estimated 1957-58 use of N, P and K is, respectively, 5·5, 7, and 4% above that of 1956-57, and may prove higher in fact But except for Western Germany, consumption by the heavy-using countries in Europe has risen by smaller amounts than these or in some cases fallen, *e.g.* Belgium's nitrogen use has fallen by as much as 10%, potash use has reduced in Belgium, Holland, Denmark, Norway and Sweden. Western Germany's 10% increases for N and K are quite exceptional among high-using countries. Europe's total rise in consumption is substantially accounted for by large expansions in use in countries like France, Greece, Yugoslavia, Ireland and Spain, *e.g.* France has increased her use of N by 20% and Greece by 25%. Phosphate use, too, though much stabilised in many countries, is sharply expanding in some of the lower-using countries.

In this European context U.K. use, as reported by FAO, displays a small upward trend—under 1% for N, about 0·5% for P, and 0·6% for K. But the estimated figures for U.K. 1957-58 use seem low.

The outstanding non-European user has, of course, long been Japan. There, too, a trend to reduce fertiliser use is indicated. N use is still rising—an increase of about 16% over two years (1956-57 to 1958-59) is estimated; but phosphate use is almost static and potash use is estimated to fall by about 10% over the same two-years period.

China is vigorously increasing fertiliser production and use, but the FAO Review cannot provide firm data. The five-year plan that ended in 1957 increased N production capacity by 115,000 tons (as N), and the target for the new five-year plan is to achieve a total fertiliser output (as tonnage of fertilisers) greater than 3 million tons. The main nitrogen aim of new plants, many of which are being constructed, is ammonium bicarbonate, and it seems uncertain on available information whether this is to be used as such or to be processed into some other N form. The ammonium bicarbonate process, said to be suitable for small factories, derives from a pilot process developed in Peking as recently as 1958.

The world pattern of fertiliser materials is changing slightly. Ammonium sulphate is slowly but firmly declining, dropping from a 33% share of all N production to 29% in the past two years. Superphosphate—single or double forms—has dropped from 74 to 69% of total P fertiliser in the past three years. These falls are mainly the result of increased shares for both N and P made by the so-called complex type of compounds, *e.g.* nitrophosphates; though a little of ammonium sulphate's share has been taken by ammonium nitrate, whose share has risen from 26 to 27%. However, the most marked expansion in recent years has been made by urea, whose fertiliser use has increased from 162,000 to 312,000 tons (as N) in four years. As yet, this rapid expansion is too small to show up as a percentage of world N use. The prilling processes, which can overcome urea's hygroscopic defects, seem responsible for its increasing use.

Phosphate use

Despite a tendency among many experts to recommend reduced rates of use for P (on the grounds that too much has formerly been applied to regularly well-fertilised soils), papers advocating the maintenance of P supplies continue to appear. With lettuce,[2] phosphate dressings gave large yield increases although the soils for the three preceding years had been heavily phosphate-treated. The main phosphate

function exercised seems to have been the hastening of maturity. Differences between no-P and P treatment were large; differences between single-dose and double-dose P treatment were small. Soil-tests of P availability may in some cases be a poor guide to phosphate needs and benefits. Once again, one is forced to plead for a specific outlook towards P nutrition of plants, *i.e.* not the same as that adopted for N and K. There are many signs that the crop/P relationship is not merely quantitative, but also has a timing factor. With many crops what may well be critical is the provision of abundant readily-available P during an early stage of development. A soil may have a good phosphate reserve, yet not supply this available-P abundance at the right time; by adding a quickly available fertiliser form of P, the soil solution may be saturated with available P speedily and during the early-growth period. The fact that all this supply of P may not be utilised, that a good part of it may eventually add itself to the less readily available reserve, may seem wasteful, but the alternative P-economising policy may at the critical time represent the ill-famed approach of " too little and too late."

Pot-tests using radioactive labelled superphosphate in oats nutrition[3] on high-P and low-P soils have shown that for both soils the percentage of fertiliser-derived P taken up rose with the rate of fertiliser application; with the high-P soil, though not with the low-P soil, there was a renewed demand for the fertiliser-derived P at the later grain-formation stage of growth. Uptake of soil-derived P was depressed by the use of fertiliser-P. Quantitatively, this may be regarded as evidence that if fertiliser-P is less generously provided, the crop plants will make better use of soil-P. But the uptake facts show that the plants " prefer " this form of fertiliser-P at times of high requirement, and this is surely an indication that soil-P is not as readily assimilated. Where delays in crop development may affect economic results, either in terms of yield or quality, the generous use of fertiliser-P in a water-soluble form seems essential. Currently, insufficient importance seems to be attached to the time factors of P supply, particularly in early plant-growth stages. It should be made clear that these comments differ from those in the paper reporting this research with radio-labelled P fertiliser.

Similar research with radio-labelled P fertilisers and with potatoes as the test crop[4] has given a contrary indication. Again high-P and low-P soils were used. The superphosphate applications reduced uptake of soil-P, especially in the high-P soil, but final tuber yields were not raised through the higher uptake of fertiliser-P. The lower rate of application of P-fertiliser hastened the start of tuber formation and maturing time; the higher rate retarded both these. After 12 weeks from planting there was little uptake of fertiliser-P on both soils. The soundest interpretation of these results seems to be that this crop has a low P requirement, and one that needs to be satisfied during the first third or half of growth-time. This, however, does not mean that other crops have similar P needs, in quantity or in time.

Sulphur

It has been shown in various experiments that grasses and clovers compete for potash. A new paper has shown that there can also be competition for sulphur.[5] Varying N rates and S rates—sulphur being given as calcium sulphate—were given to a mixed grass-clover herbage on sandy loam. In absence of N, sulphur applications raised clover yields appreciably. Increasing rates of N depressed clover yields when no sulphur or only 5 lb. per acre (as S) were given, but with sulphur supplied at a rate of 15 lb. per acre there was little reduction in clover yields. It was also shown that when no additional S was supplied, the grasses took up practically all the sulphur available in the soil; but with sulphur provided, clovers took up increasing proportions of the sulphur totally assimilated by the mixed herbage. As with potash, therefore, the clover-retarding effect of nitrogen may be interpreted indirectly rather than directly, *i.e.* the additional growth of the grasses leads to nutrient shortages (other than N) for the clovers. This is probably due to the fact of plant life that clovers develop growth later than most grasses. A deduction from this research is that ammonium sulphate may be a better nitrogen fertiliser for grass-clover swards than forms of nitrogen that do not contain sulphur. This stands in some contrast to much practice with fertilisers on clover-containing grassland, where there is preference for the combinations of ammonium nitrate with chalk.

Molybdenum

An overseas paper[6] whose abstract-report has been delayed has usefully confirmed the benefits of molybdenum already demonstrated in Australian and New Zealand experimental and field work. In Prince Edward Island, sandy loams with a *p*H of 5·3 to 5·9 were treated with 8 oz. of sodium molybdate per acre. Significant increases in clover hay yields, and in the nodulation of the clovers' roots, resulted. The yield increases were not enlarged when as much as 1,000 and 2,000 lb. of ground limestone were also given, but the higher rate of liming stimulated a greater Mo uptake by the clovers.

Complex or compound fertilisers?

First, one must deplore the rise of yet another dubious kind of nomenclature in fertiliser literature. The so-called complex fertiliser has been defined as a fertiliser containing two or all three of the NPK trio in which the nutrient are chemically combined during production. The compound fertiliser differs by being the product of mechanically mixing primary materials containing separately N, P and K. The distinction is chemical nonsense. Even before the era of granulation with its wet-treatment and heat-treatment stages, there was no basis for supposing that mixing primary fertiliser materials did not lead to chemical interactions —indeed, there was plenty of evidence that reactions between the mixed materials occurred! There seems to be no technology more handicapped by poor developments in nomenclature than fertiliser technology. Unwise nomenclature decisions in the nineteenth century have often been criticised, but today's christeners seem to be no better.

A new U.S. paper avoids this distinction by using the terms " mixed salt " fertilisers and " commercial type " fertilisers.[7] The implication that " mixed salt " (*i.e.* mechanically mixed compounds) are less " commercial " seems even cruder, and it is no less nonsensical. The paper reports greenhouse experiments to ascertain

whether there are differences in phosphate availability between the two types of NPK fertilisers. On five soils radio-P labelled fertilisers, ranging in phosphate water-solubility from 0 to almost 100%, were tested with corn and beans, both in broadcast and strip-banded placement. No substantial differences were found for the crop yields or for the crops' uptake of P. It is said that "these data are of value because it is difficult to produce well-characterised commercial fertilisers having a wide range of water solubility." It seems also of value to point out that other experiments, including field trials, have shown differing results, at any rate for nitro-phosphate types of NPK fertiliser. It is possible that greenhouse (*i.e.* growth-hastened) tests are not a sound criterion for distinguishing between the effectiveness of different forms of available phosphate; favourable soil temperatures may enable non-water-soluble P to give a better performance than in the field. However, as the FAO Review already discussed has shown, phosphate in this so-called complex type of NPK fertiliser has made some gains in use at the expense of water-soluble phosphate.

This paper has been slow to appear, for it relates to tests made in 1956.

Fertiliser practice

Yet another market survey has been reported,[8] this time by one of the larger British manufacturers. The percentages of acreages in various regions and for U.K. as a whole on which compound fertilisers are used have been assessed. Except that the regional percentage for Scotland is usually higher, the overall figures for U.K. are not seriously divergent from the regions. They are as follows:

U.K.: Percentage of acreage receiving a compound

Crop	%
Cereals	71
Potatoes	94
Sugar beet	94
Brassicæ	73
Temporary grass	30
Permanent grass	11

Adding for the grass acreages the percentages of crops receiving straight (*i.e.* non-mixed fertilisers), still only 60% of U.K. temporary grass and about 40% of the permanent grass receives fertiliser once a year. These figures cover an investigation made over the past four years and to some extent may be more up-to-date than some other recently reported surveys.

Solvent process for phosphoric acid

A patented process developed in Israel for making phosphoric acid from rock phosphate and hydrochloric acid has been discussed.[9, 10] After the rock-acid reaction, the phosphoric acid is extracted by an organic solvent of low solubility in water, *e.g.* butanol or pentanol. In a small-scale use of the process, as described, the HCl itself was first dissolved in an organic solvent, isoamyl alcohol. Using benzene as the main extractant, an aqueous phase containing acids may be separated.

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DISINFECTANTS and Disinfection

By A. H. Walters, F.I.M.I.T., M.R.S.H., M.I.BIOL.

Chlorinated antibacterials • Contamination in ophthalmic ointments Dextran as a potentiater • Antifungal activity of oils • Antibacterial activity of hæmoglobin • β-naphtha compounds as antibacterials Cleanliness in the dairy • Evaluation of disinfectants

Chlorinated bisphenol antibacterials

IT HAS been noted that thiobisdichlorophenol and hexachlorophene have similiar antibacterial properties and that both these bisphenols chelate iron and copper. The possibility that there may be a common mode of action has now been investigated[1] using *Staph. aureus* and *B. subtilis* as test organisms. To determine minimal inhibitory concentrations of thiobischlorophenol and its metal chelates, solutions of the substance and also crystalline Fe and Cu chelates were diluted in sterile distilled water and aliquots added to tubes of nutrient broth to give concentration of 0-10 ppm. The treated broths were then injected with 24 hr. suspensions of T. O. broth cultures and results read after 24 hr. at 37°C.

Results showed that the thiobischlorophenol and the metal chelates were equal in activity against *S. aureus*, but with *B. subtilis* the copper chelate is less effective.

The bactericidal activity of thiobischlorophenol in the presence or absence of metals was then tested. Other workers had shown that oxine in broth would kill *S. aureus*, but similar concentration in distilled water would not; but on adding traces of Cu or Fe, the bactericide became instantly effective in aqueous solutions.

Parallel tests showed that thiobischlorophenol is actively bactericidal in the absence of added trace metals or those normally present in broth. By contrast, oxine alone failed to inhibit growth but was activated by iron, yet thiobischlorophenol as an antibacterial was suppressed by ferrous ions but not by other metallic ions.

It was noted that the tetracycline group of antibiotics behave similarly, since these drugs act by interference with microbic enzyme systems which require metals, and also that the bisphenols have been shown to inhibit similar enzyme systems of *B. subtilis* and *Esch. coli*; it is suggested that the antibacterial action of thiobischlorophenol and hexachlorophene is due to inhibition of certain metal requiring enzyme systems.

This work is described in Part II of a double paper, the first part of which deals with the chemistry of these substances.

Sterility of ophthalmic ointments

In the U.S. the former official method for testing ophthalmic ointments for sterility consists of simply squeezing approximately 0·1 to 0·5 g. of ointment on to the surface of 20 ml. of nutrient agar in a petri dish, spreading evenly with a sterile glass rod, incubating at 37°C. for 48 hr., counting the number of colonies and calculating the total count per gram. The method of Van der Wyck and Grauston (1958) introduces a dispersion step in which the ointment is shaken with sterile glass beads in 25 ml. of distilled water for 1 hr. at room temperature, then three 1 ml. replicates are placed in petri dishes, mixed with melted blood agar and incubated at 37°C. for 24 hr. Forty-six commercial tubes of antibiotic ophthalmic ointment were tested by this method and results recently reported.[2] These samples represented 19 batches from 10 manufacturers. All tubes were labelled to contain ⅛ oz. of ointment. The antibacterial agents variously incorporated in the samples were penicillin, bacitracin, chloramphenicol, chlortetracycline and various mixtures of bacitracin, neomycin sulphate and polymyxin sulphate. Contamination was detected in two samples.

The authors comment that in their tests they found the percentage contamination in ophthalmic ointments much lower than had formerly been reported by Van der Wyck and Granston. In any case, the finding of any contamination at all in such ointments is most reprehensible.

The method of Van der Wyck and Granston would appear to be an advance on the older official method, but whether it gives the desired neutralisation and break-up of all formulations is possibly open to question.

Action of dextran in serum

Although extensively investigated, the mechanism of bactericidal activity of fresh normal serum against Gram-negative bacteria still remains unknown. Recently it was observed that human serum, when diluted with clinical dextran, appeared to exhibit a greater bactericidal activity than when diluted in saline.[3] Such potentation was unexpected and therefore investigated further. Three different clinical dextran preparations (6%) were tested. Normal serum from humans, rats and guinea-pigs was separated from blood after 1 hr. at room temperature and 18 hr. at 2°C. and stored at −70°C. The test organisms were *Sh. shigæ* (9665) and *Bact. coli* (2380). Suspensions of 18 hr. cultures were diluted in saline to contain 25,000 organisms per 1 ml. 0·02 ml. of such suspensions were added to serum dilutions of total volume 1 ml. Count cultures were made after 30 and 90 min. at 37°C. Incubation was overnight at 37°C. and the colonies then counted. The bactericidal titre was taken as the dilution of serum killing 50% of the inoculum.

The type of results obtained was as follows:

Test organism *Sh. Shigæ*

Conc., clin. Dextran in saline (%)	*Serum bactericidal titre*
0	1 : 8
0·5	1 : 9
1	1 : 12
2	1 : 17
6	1 : 71

Further experiments to ascertain the cause of this potentiating effect of clinical dextran on the antibacterial action of serum indicated that it depends on molecular weight and on polysaccharide constitution, but the mode of action was not elucidated. It was not due to promotion of agglutination or preservation or potentiation of complement. Clinical dextran did not appear directly to cause an increase of sensivity of Gram-negative organisms in serum. This work would enhance the value of dextran even further.

Antifungal activity of oils

Some oils have long been known to possess antifungal activity. The *in vitro* antifungal activity of some 92 volatile oils, 12 terpeneless oils and three fixed oils has been ascertained against 18 pathogenic and non-pathogenic fungi.[4] Labourand's maltose agar plates were seeded with 2 ml. test organisms in broth cultures and then paper discs ¼ in. in diameter were soaked in the test oil and placed on the medium surface. Incubation, according to strain, was between three and seven days at room temperature and then zones of inhibition were measured. The volatile oils ranged from Amber to Ylang-Ylang, the terpeneless oils from Anise to Sweet Orange.

Results were interpreted as indicating that 90 volatile oils exhibited antifungal activity on at least one organism. Origanum (red), lemongrass, thyme, sweet burch, savory select, coriander, sassafras, cinnamon, laurel leaves (distilled) and chenopodium exhibited greatest antifungal activity. *Streptomyces vebezulæ* appeared to be most susceptible, while *Candida Krusei* was the most resistant. Cinnamon, caraway, dill and anise were the most active terpeneless oils, while the fixed oils were inert in this specific activity.

Chenopodium and thyme (red) were active against *T. mentagrophytes* and oil of cinnamon against *E. interdigitale*. Antibacterial activity as assessed by the same techniques did not necessarily correspond with antifungal activity. As a very preliminary mass screening, this experiment is useful for reference, although obviously much more specific work is needed on the promising oils. The authors point out that apparently these oils have not received the attention in chemical application that their activity warrants. My grandmother was keen on rubbing cinnamon oil into obstinate scaly patches on the skin. She would have been pleased to know that the paper disc method of assay proved her remedy active against Trichophyton, Epidemophyton and *Ustilago avenæ*!

A further paper from the same principal author reports the *in vitro* antibacterial activity of essential oils and oil combinations.[5]

The test organisms were *S. typhosa*, *M. citreus*, *Prot. morgani*, *B. brevis* and *Micrococcus pyogenes* var. *albus*, and the techniques similar to that described for the previous tests. Forty-five oils were tested and 95 combinations of these oils. Eucalyptus, cinnamon and origanum (red) showed the greatest inhibition zones and the Gram-positive bacteria appeared to be more sensitive to volatile oils than the Gram-negative. Mixtures of oils did not appear to increase antibacterial effect.

An interesting point is made regarding the fact that some volatile oils produce arresting effects on paramecium and helminths. Chenopodium and sassafras immediately come to mind as very old remedies for " worms."

Finally, the antibacterial activity

of 100 perfume oils was similarly tested against 10 bacteria and 10 fungi and a high proportion of these were found to be active.[6]

Antibacterial activity of hæmoglobin

During studies in the antibacterial activity of various tissues it was observed that erythrocytes had an inhibitory effect on certain Gram-negative bacteria *in vitro*. Further tests now reported indicate that this function is due to hæmoglobin[7]. The tests were done in 0·02 M citric acid—sodium nitrate buffer *p*H 5. Common Gram-negative bacteria survived at 38°C. for "several hours" in this solution, but Gram-positive organisms died rapidly. All buffer solutions were sterilised by autoclaving. For the assays plastic trays containing a series of cup-like depressions of 3 ml. capacity were used. These were cleaned with 95% ethanol rinsed in distilled water, dried, placed in plastic containers with lids and the whole assembly sterilised with UV light. Serial two-fold dilutions of the test material in buffer were made in the plastic cups in 0·5 ml. amounts. For the tests, 18 hr. broth cultures were diluted 4×10^6 in buffer and a drop of 0·02 ml. containing 200 organisms was delivered into each cup in the dilution series. Mixing was by rotation, then incubation for 1 hr. at 38°C., and each cup subsequently filled with agar and allowed to solidify. After solidification the trays were incubated at 38°C. for 18 hr. The titre of antibacterial activity was read as the least concentration of material in which the number of bacterial colonies was less than 50% of those in the control cups.

Results showed that low concentration of hæmoglobin may exert a lethal action on some Gram-negative bacteria under the test conditions described. To achieve this result, the test medium must be low in ionic concentration and acid in reaction. Various strains of *Escherichia* and *Salmonella* were found susceptible, but a few strains of *Shigella Klebsiella* and *Proteus* were found resistant. Experiments made at 28° and 0° showed that at such temperatures the bactericidal action does not occur. This work is highly academic, but from the practical viewpoint the techniques employed and the clarity with which results are presented can be usefully studied. Those interested should read the paper in full.

β-Naphthol derivatives

Earlier work has shown that certain β-naphthol derivatives exhibit antibacterial and antifungal properties, and now comes further work from Bombay on selected compounds.[8] A series of ten β-naphthol derivatives were incorporated into bouillon at previously determined inhibitory concentrations and autoclaved at 15 lb. pressure for 20 min. These were subsequently inoculated with *S. aureus* and incubated at 37°C. for 45 hr. This treatment caused all the bromoanilides (4 of the 10) to lose their antimicrobial activity. All retained their inhibitory function after exposure to dry heat at 150°C. for 1 hr. Cup assay tests indicated that 1 : 6 dibromo-2-hydroxy-3-naphthamilide gave the largest zone, and this compound also proved active when incorporated into an ointment. Similar antifungal tests using *Trichophyton gypseum* showed the 1 : bromo compound to be best.

The influence of organic matter on the compounds such as hexyl-β-naphthol indicated a slowing up of attack in terms of time which may have been due to some physical surface protection of the organisms. On the other hand, this activity of 8-hydroxyquinoline seemed unaffected against fungi when horse serum was used as organic matter. Irritation tests were done by daily rubbing various concentrations of the compounds into depilated areas on the backs of rabbits every day for six days. Two compounds tested this way were non-irritant, but the 6 - hexyl - β - naphthol appeared irritant. Granuloma pouch tests confirmed these findings. Wound healing tests were done by taking three male rats, depilating them, allow to rest for 24 hr., anæsthetising and two incisions made on opposite sides of the midline. One wound was treated with ointment containing the test substance, the other used as control. In concentrations of 1%, 5%, 6-hexyl-β-naphthol and 1-6 dibromo-2-hydroxy-3-naphthanilide did not appear to retard epithelialisation. Toxicities were tested by the normal methods. The whole test structure was applied to mixtures of the derivatives and it was concluded that 6 bromo and 1 : 6 dinitronaphthols may be synergistic.

There seems to be a tremendous amount of work packed into the short paper, which smacks rather of the Ehrlich steamroller. However, the authors conclude very reasonably that "it appears from these results that the compounds may prove to be useful anti-infective agents and hence merit chemical study."

Bacterial cleanability of milk contact surfaces

A most interesting report on studies on the relative bacterial cleanability of milk contact surfaces has recently come from Cornell.[9] The authors indicate the hazards of soiling surfaces with known bacterial loads and subsequently trying to estimate, after cleaning treatment, the number of survivors by means of agar submersion or other conventional techniques. In place of these methods, radioisotopic techniques eliminate these hazards and possess high sensitivity at both high and low soil residue levels *Esch. coli.* and *S. aureus* fourth consecutive day broth cultures were inoculated into bouillon to which was added P^{32}. The cultures were inoculated at 30°C. overnight, then centrifuged and the deposit washed until clear of absorbed P. The organisms are resuspended in 0·85% saline and kept at 4°C. until used. The P^{32} labelled organisms were suspended separately in milk and 0·85 saline to about $2{\cdot}5^{10^8}$ per 1 ml. Experimental surfaces were based on stainless steel, copper glass, aluminium, nickel and plastic, cut in 1 in. diameter discs. The isotoped organisms in soils were evenly distributed on the surface of the discs by an ingenious method using a siliconised glass rod, and the quantities so distributed from 0·05 ml. were highly reproducible. For cleaning, a similar method was employed under strictly controlled conditions. The cleaning solutions used were normal alkaline formulations. Scrubbing was mechanised with the use of a nylon brush or sponge on a weighted cleaning arm which traversed the disc for a known time with a windscreen wiper action. After cleaning the discs were rinsed in distilled water and dried at 80°C. Radioassay of survivors was done by Geiger counter and also by autoradiography. Extra controls were made by normal bacteriological methods.

Results first clearly demonstrate the superiority of radioassay over submerged agar culture techniques. Generally it appeared that there

was a greater retention of bacteria upon the surface from 0·85% saline suspension than from a homogenised whole milk suspension. The latter appeared to permit a greater bacteria-surface interaction. The chemical nature of the surface together with its own geography determined the physical surface effects of soil retention and build-up. Brushing was considered effective in cleaning polished, ground and moulded surfaces and relatively inaffective in removing bacteria trapped in the surface features of cold, rolled, abraded, blasted and porous surfaces. All used dairy plant seems to come into the latter category at some time. This is a significant paper.

Bactericide/leucocide ratio

The elaboration of techniques for the evaluation of disinfectants continues apace. An attempt has now been made to ascertain at what strength a disinfectant, under given laboratory conditions, (*a*) kills bacteria, (*b*) kills leucocytes, (*c*) is non-toxic to leucocytes.[10] The test organism was *S. aureus*, an 18 hr. broth culture of which was added to a given dilution of disinfectant in the proportions of 0·2 ml. to 1 ml. and allowed to remain in contact for 10 min. at 37°C. Then a loopful was removed into 2 ml. FDA broth and thus the bactericidal dilution evaluated. Only in the case of mercurials was a neutraliser used. (Reason not given.) The leucocidal dilution was obtained by adding 0·2 ml. of difibrinated rat's blood to 1 ml. of disinfectant dilution and leaving for 10 min. at 37°, then adding 50 ml. of warm sterile saline, mixing, centrifuging for 30 sec. and decanting the supernatant. This washing process was repeated twice more. In this way a clean sediment was obtained, consisting of leucocytes after exposure to disinfectant. One ml. of an 18 broth culture of *S. aureus* was mixed with 3 ml. of sterile rat serum and incubated for 4 hr. at 37°, and 0·1 ml. of this mixture added to the leucocyte sediment prepared as above. After further incubation at 37°C. for ½ hr., a loopful was removed and smeared on to a slide, and stained by Wright's method. Ten typical polymorphonuclear leucocytes were examined for evidence of active phagocytosis of staphylococci, as indicated by ten or more organisms observed within the cells. In this way the phagocytic dilution was found, that is, the greatest concentration of disinfectant which did not interfere with phagocytosis as measured under these test conditions. Finally, the bactericidal dilution of a given disinfectant was divided by the leucocidal dilution to obtain a B/L ratio.

Results indicated that of the 15 disinfectants tested only gentian violet, Chlorox and Isodine are less toxic to white cells than to bacteria. The authors modestly suggest that their technique can give one small part of the evidence required in profile evaluation of potential disinfectants, and that it is not a substitute for clinical evaluation.

One wonders if another of Shaw's plays, "The Doctor's Dilemma," might become the libretto of a second smash hit, "My Fair Phagocyte."

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COSMETIC SCIENCE

(*Continued from page 205*)

oil, the triglyceride. This latter was referred to in America as oil of sweet almonds.

The same speaker suggested that some of the other items might have been placed in the table because an unfortunate sample might have been used containing an impurity or impurities attributable to the source of the material, the method of preparation, conditions of storage and age. Impurities due to these factors were well known and had been mentioned during the present congress. Any one of these adventitious impurities might cause irritation or sensitivity and yet may rarely be found in a good sample of the substance. The plea was made that such tables as these should describe the sample examined with relation to the factors just enumerated.

Team work in cosmetic science

As was anticipated, the statements made by Professor Bullough caused considerable discussion. The need for work with teams including workers in adjoining fields of exploration, biology, physiology and so on, was not challenged. One speaker suggested that fundamental work on such matters as skin reactions, the ministering to the needs of skin deficiencies and so on, should be undertaken by a central research station set up by the industry. Such an organisation could publish the results of its work for the benefit of the whole industry. There would be little advantage in preserving such results for use by a small number of firms if the community was to suffer from inferior products prepared by firms not sharing the advantage of the latest research work.

The American Toilet Goods Association some years ago set up a scientific section to carry out such work and they publish results in the Proceedings of the Scientific Section of the Toilet Goods Association of America, a valuable journal with a world-wide circulation.

During the discussion Professor Bullough announced that Dr. W. Montagna, working under the auspices of this organisation, had achieved remarkable advances in cosmetic science which would be published at an early date.

Treatment for tuberculosis. A booklet from Ciba Laboratories Ltd. describes the treatment of tuberculosis with their antibiotic, *Vionactane*. This is a mixture of two viomycin salts, the pantothenate and the sulphate, a combination which is said to be better tolerated locally than the sulphate alone and less likely to cause side effects.

Cellophane samples. A folder from British Cellophane Ltd. contains sample of plain and coloured transparent cellulose film and gives details of approximate gauges and yields of typical films. The film is made in three standard gauges and in a range of different types, coated and uncoated. It is supplied in continuous rolls of any width from 1 in. up to 81 in. and in cut-to-size sheets.

BOOK REVIEWS

New and Nonofficial Drugs 1959

Lippincott, Philadelphia. Issued in the U.K. by Pitman, London. Pp. 687. 30*s. net.*

THIS annual publication of the Council on Drugs of the American Medical Association contains descriptions of drugs evaluated by the Council. Preparations are grouped according to pharmacological action or clinical use. Descriptions are given under non-proprietary names and provide the following information: chemical or biological identity, actions and uses and dosage. Cross-references may be made to monographs describing drugs that share actions or uses of drugs described in different chapters. There is a good index.

Gas Chromatography 1958

Edited by D. H. Desty. Butterworths, London. Pp. 383. 70*s.*

"GAS Chromatography" is a companion publication to "Vapour Phase Chromatography" and is a compilation of the papers given at the Symposium on Gas Chromatography held at the Royal Tropical Institute, Amsterdam, in May 1958. The Symposium was organised by the Gas Chromatography Discussion Group, under the auspices of the Hydrocarbon Research Group of the Institute of Petroleum and the Koninklijke Nederlandse Chemische Vereniging.

A total of twenty-eight papers were submitted by leading workers in the field of gas chromatography and are ranged in the form they were presented at the meeting.

(i) *Theory of Gas Chromatography*

Papers presented in this section include the theory of high efficiency columns, the theory of capillary columns, the determination of activity coefficients by gas-liquid chromatography.

(ii) *Techniques and Apparatus*

In this section the constructional details of the highly sensitive flame-ionisation detector and the emissivity detector are given and a very simple type of catherometer, made from a small electric light bulb, is described. Work on the response of the hydrogen-flame detector and the use of programmed columns for analysis will be of interest to workers already using this type of equipment. A paper on high-efficiency columns gives constructional details for producing columns of 30,000 plates efficiency.

(iii) *Applications*

The section on application contains papers dealing with preparative columns, the chromatography of highly reactive gases, the analysis of essential oils, phenols and amino acids, and high-temperature chromatography. The many applications described in this section makes the book of particularly wide interest.

Mr. Desty has without doubt again provided a very valuable and compact source of detailed information on gas chromatography, which will be of great value both to workers developing the technique and to those applying it.

R. P. W. SCOTT.

Colorimetric Chemical Analytical Methods

The Tintometer Ltd. 5th Edition. 360 *pp.* 30*s. net.*

THIS edition has been redesigned in loose-leaf form so that revision can be carried out with the minimum of inconvenience. Each book is sold with an offer of free copies of new additional pages as they are issued for a period of two years. The text has been almost entirely rewritten and twelve new monographs added.

Divided into seven colour-coded sections, the book contains details of many chemical tests which are in current use, and which have been specially developed for use with Lovibond standards. Each test is discussed in relation to the various applications which may be required, with, in many cases, general background notes concerning reliability, special precautions and suggested uses. Details of reagents required and step by step technique for performing the test are also given, and there is a list of bibliographical references for further reading if required. Over 150 different tests are dealt with, and fresh tests will be added to the book as they become available.

Designed primarily for use with visual methods, this book should prove of particular use in the rapid routine analysis and checking of a large number of substances. The system of indexes and colour-coded pages are a considerable help to easy and rapid reference.

Annuaire des Produits Chimiques et de la Droguerie

74th edn. Annuaires Rousset, Paris, 1958. *Pp.* 2263. 4,000 *fr. net.*

THE British pharmaceutical and fine chemical industries are not as well served with directories as they might be, and this work, which is international in coverage, should be useful to British firms. The first section lists manufacturers of chemical products in 19 countries, mostly European, and plant manufacturers in 11. Coverage for Great Britain compares well with British lists, and products are given in English for all British firms, but in French for all others. The bulk of the book is divided by names of products in French (there is an English index to these) with suppliers listed under countries. It tends to be weak for plant and for organic synthetics, but is good for natural materials and compounded products.

There is a list of French retail pharmacists, by *départements*, a list of dealers in chemicals, drugs and colours in nine countries, and a list of export and import firms in 16 countries. The two latter lists include Great Britain.

Northern Ireland is almost and Eire quite ignored. The U.S.A., Argentina and Chile are covered, but not the overseas Commonwealth.

The printing, by French standards, is reasonably good, but a better binding is needed. The English would benefit here and there by expert revision but is generally comprehensible.

D.J.C.

PLANT AND EQUIPMENT

▶ELEVATOR TRUCKS

Constructed of heavy gauge steel channel, *Vertolifter* hydraulic elevator trucks made by Powell and Co. have lifting capacities of 1,200 lb. and 1,600 lb. Operation is by a two-speed pump which may be either hand or power driven. Two heights of lift are available, to either 60 in. or 75 in.

▶GLASS-LINED VESSELS

A new range of acid-resistant glass-lined steel equipment for use in the chemical and pharmaceutical industries is available from QVF Ltd.

The equipment is said to give a high degree of resistance to chemical attack, to extreme temperatures, to sudden changes in temperature caused by heating and cooling processes, and to be pressure and vacuum resistant. According to the manufacturers the non-porous glass enamel coating used in the tanks and vessels consists of several layers and may be exposed to temperatures of up to 250° and to reductions to -50° C., without risk of damage.

The equipment includes open vessels, evaporating pans, open and closed jacketed tanks, receivers, a range of reaction kettles; storage tanks, heat exchangers and stuffing boxes. Capacities vary in most cases from 40-8,000 litres.

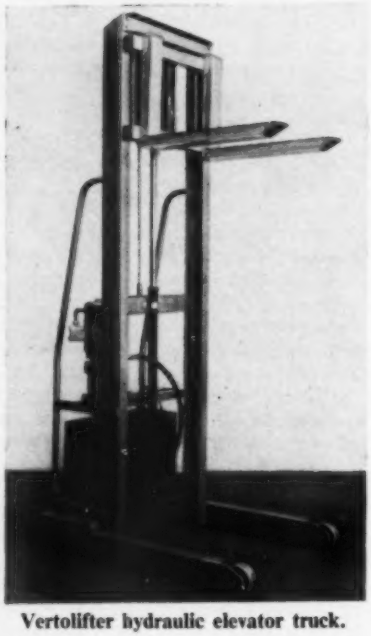
QVF are acting as agents for the Schwelmer Eisenwerk (Muller and Co.) of Schwelm, Westphalia.

▶CORROSION-RESISTANT VALVE

The *Rayon-Patent* stop valve, made by Meynell and Sons Ltd., is said to be suitable for controlling the flow of almost any fluid or gas up to a maximum temperature of 100°C. The upper part of the rubber valve is so shaped that the movable parts of the stop valve remain isolated from the liquid, eliminating the need for packing glands. The design of the clack and the clack seat and the elimination of pressure on that part of the clack separating the fluid-controlled from the working mechanism is claimed to ensure a long period of service without need for replacement.

The closure of the valve is made by means of a rubber clack which is moulded integrally with a gasket which separates the line fluid from the working mechanism. According to the manufacturers the design of the clack is such that even if the gasket should rupture, the valve can still be closed off. Various types of clack available include natural and synthetic rubber and nylon, and the valve is available either screwed or flanged.

Floor model of the Perry Acofil Lab Gun.



Vertolifter hydraulic elevator truck.

It is said to be suitable for use in absolute vacuum.

The same company also manufacture a manually-operated mixing valve, designed for use in showers and washrooms, which is said to give automatic shut-off in the event of cold water failure. A minimum head of 4 ft. is required for installation.

▶POWDER FILLING

The *Perry Acofil Lab Gun* available from the Flexile Metal Co. Ltd. is said to be suitable for filling cosmetics, aerosol dispensed powders, insecticides and similar products. It consists basically of a cylinder and adjustable piston combination in which a vacuum-pressure cycle is introduced. It is stated that the piston can be adjusted to the exact fill required with a range of from 20 mg. to 5 lb. per fill.

In operation the gun is first adjusted to the exact fill required and its nozzle is then inserted in the bulk powder container, when it is automatically filled. The gun is then inserted in the container to be filled, a foot pedal is depressed and a slug of powder is deposited in the container. It is stated that fills may be at speeds varying from 15 to 30 per min., depending on the weight of the fill, and with accuracies of $\pm$ 1%.

A floor and a table model of the filler are available. On the floor model only, stainless steel bacterial retentive filters can be supplied to filter the compressed air transmitted to the cylinder-piston combination. The cylinders available range in diameter from $\frac{1}{4}$ in. to 6 in. and are made in aluminium, brass, stainless steel and Plexiglass.

▶TEMPERATURE CONTROLLER

A saturable reactor type proportional temperature controller, the *S.R.*1, has been produced by C.N.S. Instruments Ltd., to meet the need for a temperature controller with no moving parts which will provide close control of furnace temperature. It is operated by a resistance thermometer whose change of resistance with temperature is used in a bridge system to give a continuously variable current which governs the output of a saturable reactor or transductor. This controlling current varies from 5 to 100 milliamps D.C. with a load of 2,500 ohms maximum. The controller is used in conjunction with a reactor of suitable size for the particular furnace 1 kVA. Used with a 1 kVA reactor the power supply to a furnace can be set from 200 VA to 1 kVA by adjustment of the bridge precision potentiometer. After this setting any variations in the resistance of the thermometer due to temperature changes in the furnace will readjust the current to maintain constant temperature. A 1% change in absolute temperature is said to be sufficient to swing the control current from its maximum to its minimum value and temperature errors which would occur without the controller are

reduced by a factor of 600 approximately, whether they are due to mains voltage variations, ambient temperature changes or varying thermal constants. This means that the overall effect of a mains voltage change of 5% on a furnace operating at say 700°C. can be reduced to within ± 0·2°C.

The controller is compensated for mains voltage variations, and saturable reactors are available for use with it which will, it is stated, enable almost any furnace or oven to be run directly from the mains supply whether 110 or 240 v.

According to the manufacturers the controller is compact and attractive of appearance, and its layout is such that valves are easily accessible and can be removed and replaced without interrupting the furnace operation. Setting of the furnace temperature requires the operation of one control knob only and the range of temperature which can be covered, using only one resistance thermometer, is approximately 800°C.

▶CHECK-WEIGHING

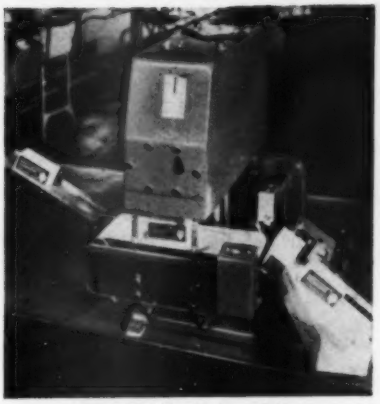
An automatic check-weigher is used by Beecham Pharmaceuticals Ltd. to ensure that the packs of their small size Beecham's Powders are to a specified weight after being filled, and consequently that each pack contains the correct number of powders.

The machine is an 86*N*9 check weigher produced by W. and T. Avery Ltd. It handles packs of approximately 500 gr. total weight each. The set tolerance is of ± 10 gr. with a fundamental accuracy of 1·2 gr. The maximum rate of checking is 55 packs a minute, the packs at present being hand-fed. The total daily output through the check weigher is 2,060 dozen.

The check-weigher consists of a small belt conveyor mounted on a sensitive weighing mechanism; the conveyor is driven remotely by a motor mounted on the base plate and the weighing mechanism is fitted with two photo-transistors which are automatically brought into operation at pre-set weight tolerances. A further photo-transistor is located near the delivery end of the conveyor, its associated beam of light passing transversely across the belt.

The speed of the belt is such that after a packet has passed on to the conveyor, the scale settles to its correct indication before the packet reaches and intercepts the transverse light-beam. This interruption causes the signals from the photo-transistors in the weighing mechanism to be transmitted to the selector mechanism, which is automatically set according to the weight zone of the packet.

The position of the selector remains unchanged between successive articles in the same weight zone, changing only when an article in a different weight



Avery 86N9 check weigher.

zone is presented to it. This arrangement is said to reduce wear and tear on the selector mechanism. Provision is made for all articles to be automatically rejected if any part of the equipment fails to function.

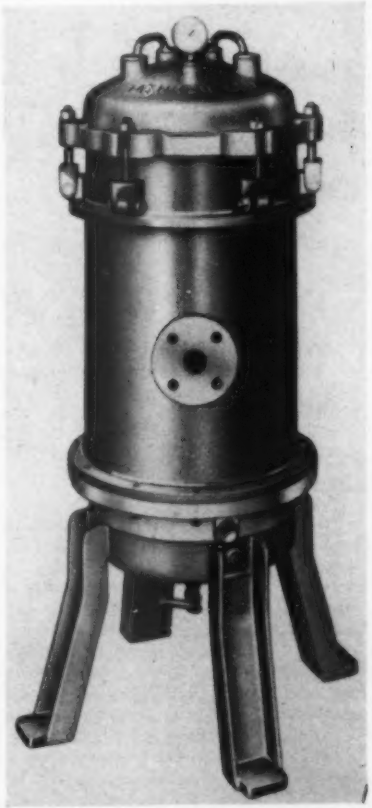
Selection may be into two or three groups: correct and incorrect, or correct, light and heavy. After weighing, each article is directed into an appropriate discharge chute, according to whether it is correct or incorrect in weight. Coloured signal lights or counters can be operated in cases where physical sorting is unnecessary.

The nominal weight of the article is set by means of weights placed in a pan, and the tolerance can be set anywhere within the chart range. The weigher operates to a tolerance of ± 5 gr.

The speed of operation is determined by two factors—the weight of the article and its size. Approximate figures give some indication. 1 oz. articles, dependent on size, may be handled at a rate of about one per sec., while the speed is roughly halved for articles weighing 8 oz.

The maximum weight that can be handled is 12 oz., and the approximate maximum size 5 in. × 3 in. × 2 in.

Special machines can be designed to deal with various types of articles and to fit into existing of projected conveying systems.



Interchangeable cartridge media for the Menrow multi-purpose treatment unit make it suitable for a number of filtration uses.

▶EQUIPMENT FOR FILTRATION

Menrow Ltd. manufacture equipment for all phases of industrial filtration. The *B*25 size pressure filter of the plate and frame horizontal type is one of a range of three sizes covering flow rates of 120, 350 and 600 g.p.h. Another range is represented by the *D*80 *Menrow* filter press which has a flow rate up to 7,000 g.p.h. It consists of 36 circular filter plates stacked to form a vertical filter press. The press is totally enclosed and according to the manufacturers is entirely surrounded by liquid when in operation so that pressure is equalised to all sections of the filter.

In addition the company makes a multi-purpose treatment unit which can be produced in sizes up to flow rates of 1,400 g.p.h. It has been designed as a simple unit with a wide application by the use of filter baskets or candles, micro-screen gauze elements wire wound strainer elements or throw-away filter cartridges. The throw-away cartridge consists of a fibre cellulose cylinder produced in a laminated form with layers of three different porosities so that coarse dispersants are trapped on the outer layer and finely micronised dispersants are filtered out by the inner layers. The cartridge is bonded by an epoxy type resin to ensure rigidity before and after use so that it can be simply extracted after the filtering operation to be replaced by a fresh cartridge. Various formulations of this cartridge are available for different applications.

For more information about the plant and equipment described please use the coupon on page 228

NEWS . . .

Drug price control and N.H.S. savings

It seems that voluntary regulation of the prices of proprietaries is not saving the Health Service as much as was expected. This must be inferred from a remark of the Minister of Health, Mr. Walker-Smith, at the A.B.P.I. dinner in London on April 29. The Ministry, he said, thought the savings were small, but the scheme still has another year to run so final judgment should be suspended. The export price criterion might not after all be a reliable guide to what should be charged in the U.K., but in proving that U.K. prices were lower than export prices for the same product the scheme had done a valuable service.

The Minister was alluding to the voluntary price regulation scheme introduced by the industry in April 1957, one of the main principles of which is that the U.K. price of a product should not exceed the export price. It was anticipated that the scheme might save the N.H.S. £750,000 a year.

Mr. Walker-Smith's disappointment that this level of savings had not been reached was the only controversial note in a speech in which he was at pains to show his appreciation of the industry. As a topical example of the way the industry served the nation, he cited polio vaccination. So far 26 million doses had been issued—5·25 million in the last few weeks. Finally the Minister assured his audience of over 500 that he would try to ensure that no action of his prevented the industry from earning the wherewithal for adequate research.

Mr. Walker-Smith was replying to the toast of the guests proposed by the president, Dr. Thomas Kerfoot, in a graceful and witty speech. Dr. Kerfoot said that the industry had continued to publicise itself "with modesty and dignity." But if it was to do better it needed more statistical information from member firms. A series of brochures was being prepared to publicise British pharmaceutical achievements.

A formal code of marketing practice had been accepted by all member firms.

Tribute to Dr. Kerfoot

After the formal speeches an unexpected and unprecedented tribute was paid to the retiring president by Mr. R. L. Taylor, a former president. He said he was speaking for all in saying that Dr. Kerfoot was the best president the association had ever had.

Annual report

In the Annual Report 1958-59 of the A.B.P.I. the association says that there is a need for more facts about the provision and use of drugs, particularly the savings to the N.H.S. which the use of modern drugs produces. Manufacturers and wholesalers receive less than 7% of total N.H.S. expenditure. In 1948 the industry, employing 48,600, had a turnover of £73m., of which £15·8m. was exported; the provisional figures for 1957 show that the industry, employing 52,400, had a turnover of £150·4m., of which £39·6m. was exported.

Scientists from the Isotope Division of the A.E.R.E., from the London School of Pharmacy and from 18 member firms continue to explore the possibilities of radiation sterilisation of drugs.

Additives in animal feeds

Drugs and other additives in animal feeding stuffs are to be declared on labels from June 1. A scheme for voluntary declaration of additives had been agreed by the trade associations concerned and the Ministry of Agriculture. Already antibiotic additives have to be declared under the Therapeutic Substances Act and sulphonamide coccidiostats and arsenical growth promoters under the Poisons Act.

The substances covered by the scheme include the coccidiostats—nitrofurazone, nitrophenide, nicarbazin, pyrimethamine; the anti-blackhead drugs aminonitrothiazole, acinitrazole and furazolidone. Added copper (normally in the form of copper sulphate) in excess of 50 p.p.m., and the synthetic hormones stilbœstrol, hexœstrol, dienœstrol. Also included are the intermediates for the preparation of stilbœstrol, hexœstrol and dienœstrol—dianisyl hexane, dianisyl hexene, dianisyl hexadiene and dienœstrol diacetate. The label attached to each container, or for bulk deliveries the invoice, will include the "name of the additive and the rate of inclusion at the time of manufacture," together with any special instructions regarding giving the feed and a warning that additional medicaments should not be given in any form without consulting a veterinary surgeon.

Pharmaceutical conference

The British Pharmaceutical Conference will be held in Bournemouth from September 21 to 25. Full details may be obtained from the honorary general secretary, 17 Bloomsbury Square, London, W.C.1.

Public hearings of patents cases

The Board of Trade have laid before Parliament rules made under the Patents Acts 1949-57, providing for the admittance of the public to the hearing of certain patent matters by the Comptroller General of Patents, Designs and Trade Marks. Normally in the past such hearings have been in private.

Symposium on fluorine chemistry

An international symposium on fluorine chemistry, sponsored jointly by the Chemical Society and the University of Birmingham, will be held in the University of Birmingham from July 14 to 17. Registration should be made before June 13, and applications forms may be obtained from the General Secretary, the Chemical Society, Burlington House, London, W.1.

Whooping cough vaccine report

A British Standard Pertussis Vaccine has been prepared from a batch of vaccine giving good protection in field trials, and by employing this standard in comparative mouse-protection tests it will now be possible to ensure that vaccines which are used for immunisation against whooping cough will produce substantial protection against the disease.

This is stated in the Final Report of the Whooping Cough Immunisation committee of the Medical Research Council which was published last month. (See *B.M.J.*, 1959 (5128)994).

Mace presented by Wellcome

A mace has been presented by the Wellcome Foundation Ltd. to the Borough of Dartford in token of the company's long association with the borough. The presentation was made by Mr. A. A. Gray, M.C., J.P., a director of the Wellcome Foundation Ltd. to the Mayor of Dartford. Mr. Gray is in charge of the Wellcome chemical works, the principal chemical and pharmaceutical manufacturing unit of the Foundation, which has been established in Dartford since 1889.

Roughly 44 in. in length and weighing 120 oz., the mace is made throughout in silver, and is supported on a stand in English walnut with rests of rosewood. It bears the coat of arms of the borough and a group of decorative devices to symbolise education, hospitals, the chemical and paper industries, and the Church. Around the head is engraved "Borough of Dartford" and the name of the present Mayor of Dartford.

Agents for lecithin

Fatoils Ltd. 91-2, Bishopsgate, London, E.C.2, have been appointed by the Archer-Daniels-Midland Co., New York, large producers of soya oil in the United States, as their sole selling agents for lecithin, which they are producing in plastic and fluid, bleached and unbleached uniform grades.

New premises

Founded in 1922 as an agency specially organised to serve technical advertisers, The Technical Advertising Service has been established at Aldwych House, London, W.C.2, since 1930. The organisation has now moved into larger offices at 83/89 Kingsway, W.C.2. Telephone numbers are not changed. Telegrams: Selmortec Westcent London.

Shell separate chemical activities

Four new companies, subsidiaries of the Shell Petroleum Co. Ltd. and Bataafse Petroleum Maatschappij N.V., came into operation on April 6. They will take over certain supply activities and responsibility for giving advice and services to the operating companies which make up the Royal Dutch/Shell Group. Shell Petroleum and B.P.M. will henceforward function mainly in a shareholding capacity. The new companies are: *For oil:* In London—Shell International Petroleum Co. Ltd.; in The Hague—Bataafse Internationale Petroleum Mij., N.V. *For chemicals:* In London—Shell International Chemical Co. Ltd.; in The Hague—Bataafse Internationale Chemie Mij., N.V.

The reason for forming separate companies for the chemical business is its growing importance and the basic difference between the chemical and the oil industries.

I.C.I. to make polypropylene

Imperial Chemical Industries Ltd. is to extend its polyolefine activities with the introduction of a new polypropylene plastic under the trade name *Propathene*. An agreement has been signed whereby I.C.I. acquires a licence under the Montecatini and Montecatini/Ziegler U.K. patents covering the production and use of this new plastic material, originally discovered by Professor Natta.

A new plant to manufacture *Propathene* is being constructed at Wilton Works in North Yorkshire. It will bring the company's total polyolefines capacity for *Alkathene* and *Propathene* to over 100,000 tons p.a.

The product is at present being manufactured at a pilot plant, and arrangement have been made to augment this pilot plant production so that the material will be available in substantial commercial quantities from June 1.

Sanotogen to be made in N. Ireland

Fisons Ltd. have decided to transfer the manufacture of *Sanatogen* to Northern Ireland. The new plant will cover 20,000 sq. ft. and be on the site of the milk products factory at Coleraine. An additional 50 operatives will be needed, at least half of them men.

Sanatogen is at present manufactured at Loughborough, but liquid milk supplies in the area are insufficient to meet the present demand for the product. The transfer of the plant will be undertaken in two stages. Full production at Loughborough will go on until the end of July. Then half the plant will shut down and transfer to Coleraine. It is anticipated that by the end of the year the transfer will be complete and that, by March 1960, the plant will be in full production.

Guidance on non-proprietary names

The sub-committee of non-proprietary names of the World Health Organisation has made a number of suggestions for devising international non-proprietary names for drugs. The general principles are as follows:

1. Names should, preferably, be free from any anatomical, physiological, pathological or therapeutic suggestion.
2. An attempt should first be made to form a name by the combination of syllables in such a way as to indicate the significant chemical groupings of the compound and/or its pharmacological classification. Preference should be given to the following syllables:—

Latin	*English*	*French*	
inum	ine	ine	for alkaloids and organic bases
olum	ol	ol	for alcohols and phenols (—OH group)
alum	al	al	for aldehydes
onum	one	one	for ketones and other substances containing the CO group
enum	ene	ene	for unsaturated hydrocarbons
anum	ane	ane	for saturated hydrocarbons
cainum	caine	caine	for local anaesthetics of the procaine type
mer	mer	mer	for mercurial compounds
sulfonum	sulfone	sulfone	for sulfone derivatives
quinum	quine	quine	for antimalarial substances containing a quinoline group
crinum	crine	crine	for antimalarial substances containing an acridine group
sulfa	sulfa	sulfa	for derivatives of sulfanilamide having an antibacterial action
dionum	dione	dione	for anti-epileptics derived from oxazolidinedione
toinum	toin	toine	for anti-epileptics derived from hydantoin
stigminum	stigmine	stigmine	for anticholinesterases of the physostigmine (eserine) type.

3. Names should be distinctive in sound and spelling. They should not be inconveniently long and should not be liable to confusion with names already in use.
4. The addition of a terminal capital letter or number should be avoided as far as possible.
5. Names proposed by the person discovering or first developing and marketing a pharmaceutical preparation, or already officially adopted in any country, or used in national pharmacopoeias, or in works of reference such as "New and Non-official Drugs," should receive preferential consideration.
6. Cognisance should be taken of the names of closely related substances and, where desirable, the name should show this relationship.

Agents appointed

Metal Containers Ltd., 17 Waterloo Place, Pall Mall, London, S.W.1, have appointed Turner and Brown Ltd., Davenport Works, Davenport Street, Bolton, as their sole northern agents covering Lancashire, Yorkshire and Scotland for their range of *Valethene* moulded polythene tanks up to 250 gal. capacity.

Dow's £1m. factory

King's Lynn has been selected by Dow Agrochemicals as the site of a new factory for the manufacture of a selective weedkiller. They have acquired a 66-acre dockside site and construction work is to start immediately.

Dow Agrochemicals was formed in Britain last year by the Dow Chemical Co. of the United States in partnership with Dr. W. E. Ripper.

Surface heating exhibition

The Merseyside and North Wales Electricity Board is organising an exhibition dealing with surface heating by electricity at the Board's Industrial Development Centre, 83 Paradise Street, Liverpool, from May 20 to 29, in conjunction with Isopad Ltd. and other firms.

Exhibition programmes are available from Isopad Ltd., Barnet By-Pass, Boreham Wood, Herts., or M.A.N. W.E.B., Liverpool 3.

New office block for Boots

Work has begun in Station Street, Nottingham, on the erection of an £800,000 six-storey office block for Boots Pure Drug Co. Ltd. The proposed H-shaped block is the first stage of a ten-year office building programme being carried out by Boots and is scheduled for completion early in 1961. It will allow for a 30% expansion in the firms' need for accommodation for office facilities.

The new building will be the fifth major construction carried out by Boots in Nottingham since the end of the war, with erection of a large printing works, a power house, a new warehouse block and the £750,000 biological research and standards laboratory block which is near completion.

The office block is being erected on part of the site of the company's old printing works which were destroyed in an enemy air raid on Nottingham in 1941.

There will be 156,000 sq. ft. of accommodation in the 80 ft. high building; a feature will be a basement parking area with space for 32 cars.

It is planned to bring together in the new block several departments which are at present scattered in various buildings in Nottingham. Among the chief of these are the personnel and training departments, the Industrial Health Unit, and the Buying Offices.

Officers elected

The following were elected officers and members of the executive committee of the British Disinfectant Manufacturers' Association at the A.G.M.

Chairman, Mr. H. C. Askew, Reckitt and Sons Ltd.; vice chairman, Mr. S. L. Waide, Newton Chambers and Co. Ltd., Honorary Treasurer, Mr. V. G. Gibbs, Wm. Pearson Ltd.

Howards to make phthalic anhydride

Howards of Ilford Ltd. are to install a phthalic anhydride unit at their works at Ilford. This unit, which will have a planned capacity of 3,000 tons p.a. will be based on a proved continental design which produces a high yield of high-quality material and has been operated successfully for a period of years. Site preparation is well advanced and it is expected that the plant will be on stream by the end of 1959.

Part of the output of the plant will be utilised by the company for the manufacture of specialised phthalate esters, but a substantial proportion will be available for sale.

Considerable surplus production capacity for phthalic anhydride exists both in the U.S.A. and Europe as a whole, but, up to the end of last year, the U.K. was a large importer. The major producers in the U.K. have recently announced increases in their production capacity and Howards estimate that, when their own plant comes on stream, the needs of the U.K. market will be fully met from home production.

Garden chemicals

The Shell Chemical Co. have added 4% *Malathion Dust* to their range of garden chemicals. This material is said to give a rapid kill to aphids such as greenfly and blackfly on vegetable crops and flowers. It also destroys thrips, red spider, whitefly, woolly aphis and caterpillar.

The company say that the product should be dusted on to crops liberally at a rate of about 1 oz. per 10 sq. yds. The treated crops should not, however, be harvested and eaten for seven full days after application of the product. It should not be applied to ferns and certain species of crassula.

4% *Malathion Dust* is available in a refillable, flexible, polyethylene *Puffit* pack which has a newly designed top enabling it to be used either way up. The price is 3s. 6d. per pack.

The company's *Nitra-Shell* nitrogenous fertiliser is now available in small packs for use in the garden. *Nitra-Shell* contains 20·5% nitrogen and 36% carbonate of lime. The nitrogen and lime are balanced to enable the product to be used on all types of soil. Packed in 2½ lb. polyethylene bags, the price is 3s. 9d. per pack.

Lepetit deny infringing Cyanamid patent

With reference to the announcement by Cyanamid International's spokesman, Mr. R. T. Bogan, concerning the patents action brought by American Cyanamid Co. against Lepetit S.p.A. Milano, Italy, in Benelux countries (see MANUFACTURING CHEMIST, March 1959, p. 138), the latter company has issued the following statement:

(*a*) Lepetit S.p.A. claims to be the true and first inventor of its own original process for the manufacture of tetracycline. Patent applications covering the inventions have been filed in many countries in the world and some relevant letters of Patent have been already granted to Lepetit.

(*b*) Lepetit S.p.A. is a licensee of Pfizer Corporation, New York, N.Y., for nearly all countries, Belgium and Holland included. It is well known that Pfizer was the first in the world to discover the antibiotic substance tetracycline and to obtain patent protection on this drug and on a process of manufacturing the same.

(*c*) Lepetit S.p.A. denies the validity of American Cyanamid Co.'s process patent on tetracycline, and besides opposing its being granted in Great Britain and Germany, is filing a petition for revocation in Belgium and Holland.

Ciba Fellowships awards

The Advisory Panel of the CIBA Fellowship Trust have awarded the following Fellowships for the academic year 1959-60:

Dr. M. H. Richmond (Cambridge University and the Medical Research Council) to study at Copenhagen University (Microbiology);

Mr. V. P. Arya (Banaras University and London University) to study at the Polytechnic, Zurich (Natural products chemistry);

Mr. J. F. Counsell (Bristol University) to study at Göttingen University (Physics);

Mr. G. L. Duncan (Aberdeen University) to study at Louvain University (Polymer chemistry);

Mr. K. Jones (Sheffield University) to study at Heidelberg University (Organic chemistry); and

Mr. B. L. Mordike (Birmingham University and Cambridge University) to study at the Max Planck Institute, Stuttgart (Physical metallurgy).

Changes of name

The following companies in the Evans Medical Group are now operating under new names:

Evans Medical (Northern) Ltd., Newcastle-on-Tyne, formerly Evans Medical Supplies (Northern) Ltd.;
Evans Medical (India) Private Ltd., Bombay, Calcutta and Madras, formerly Evans Medical Supplies (India) Private Ltd.;
Evans Soc. Anon., Paris, formerly Laboratoires Evans Soc. Anon.; and
Evans Medical (Ireland) Ltd., Dublin, formerly Evans Medical Supplies (Ireland) Ltd.

Company finance

Monsanto Chemicals Ltd. net profit for 1958 was £629,564 (£864,374), and a total dividend of 13½% was declared for the year.

British Oxygen Co. Ltd. A final dividend of 6% less tax, together with a special interim dividend of 2% in respect of the year ending September 30, 1959, has been declared. Net profit for the year was £2,876,208 (£2,440,245).

Albright and Wilson Ltd. declared a dividend of 17% for the year ended December 31, 1958. Profit for the year, after tax, amounted to £1,723,000 (£1,612,000).

Joseph Crosfield and Sons Ltd. showed a net profit of £887,793 (£883,349) for 1958. A dividend of 25%, after tax, was declared.

Glaxo Laboratories Ltd. A 5½% interim dividend was declared on the Ordinary stock which will be payable on June 12. The net profit of the company for the six months ended December 31, 1958, was £1,178,000; this figure includes figures for Allen and Hanburys Ltd. Group turnover was 3% less than the corresponding period of the previous financial year and 6% less than the six months ended June 30, 1958.

The British Oil and Cake Mills Ltd. showed a net profit for 1958 of £2,351,304 (£1,476,783), of which dividends will take £1,132,591.

Evans Medical Supplies Ltd. Group net profit to December 31, 1958, was £187,606 (£157,014). Dividend is maintained at 7½d. per 5s. unit, less tax, and the company is paying a special sesquicentenary distribution of 2d. per 5s. unit from capital reserves.

Sales of the **Colgate-Palmolive Co.**, U.S.A. set new records last year with sales totalling $534,047,000, an increase of $27,137,000 over the 1957 figure of $506,910,000.

William Gossage and Sons Ltd. have recommended an ordinary dividend, after tax, of 20% amounting to £140,000, for the year ended December 31, 1958, the same as for 1957. The net profit for the year was £162,699 (£186,482).

People

Alec Taylor, manager of the "Cellophane" sales division, British Cellophane Ltd., has been appointed a director of the company. He joined the company in 1938 as a trainee. He is 43.

Dr. E. J. Solvay, of Brussels, has been elected president of the Society of Chemical Industry. He will succeed Sir Robert Robinson, who will complete his term of office on July 10. He is the son of the Solvay who founded the famous Belgian chemical firm of that name.

Norman Berry

J. A. Egglestone

Sir Ewart Smith

Norman Berry, M.P.S., M.S.M.A., has been appointed General Sales Manager of Burroughs Wellcome and Co. (Pakistan) Ltd. He took over his new duties early in April.

Mr. Berry joined the company as a medical representative in 1946 following demobilisation. In February 1958 he was promoted manager of the Home Sales Department (Veterinary).

A. Lewis, senior maintenance foreman of Glaxo Laboratories Ltd., Greenford, Middx, and **H. R. Williamson,** production foreman, Glaxo Laboratories Ltd., Ulverston, Lancs., recently took part in a two-week study tour of German industry organised by the Industrial Welfare Society.

I. E. Williams has been appointed secretary of Quickfit and Quartz Ltd., of Stone (Staffs.) in succession to Mr. J. C. Steer, who has resigned. Mr. Williams joined the company in 1947 in the glass-grinding department. He transferred to the accounts office, studied accountancy in his spare time and qualified within two years. In 1952 he became chief accountant.

J. A. Eggleston, B.SC., F.R.I.C., head of the standards laboratory at the Airdrie factory of Boots Pure Drug Co. Ltd. since that works was opened ten years ago, has retired. A Nottingham man, Mr. Eggleston joined the company in 1915 as a laboratory assistant before he joined the South Nottinghamshire Hussars and eventually served in the Tank Corps. During his stay in Scotland Mr. Eggleston served on the Glasgow and West of Scotland Society of Chemical Industry committee and had been its representative on the Fine Chemicals Group. He was secretary of the St. Andrews Congress on Modern Analytical Chemistry in Industry, in 1957.

His son is a textile research chemist and his daughter a librarian. Mr. Eggleston, who will be succeeded by his present assistant, **J. W. Murfin,** B.SC., F.R.I.C., will spend his retirement in Ashford, Kent.

Dr. D. Dine, Export Sales Manager of Marchon Products Ltd. has completed a seven-week tour of his company's more remote markets. He visited Pakistan, India, Thailand, Singapore, Australia, New Zealand and South Africa.

Lord Rothschild, F.R.S., has joined the board of "Shell" Research Ltd. as part-time adviser on research. He is an assistant director of research in the Department of Zoology, Cambridge University. He was chairman of the Agricultural Research Council for ten years.

Lord Rothschild, who is 48, comes from a family with long-standing scientific achievements. It was not until the war that the name of the present Lord Rothschild became widely known to the public as a scientist, although he had already done distinguished research work in biophysics in Cambridge, being elected a Fellow of Trinity College in 1935. Most of his work during the war years remains secret. It is known, however, that he worked on bomb disposal. He was awarded the George Medal in 1944 for "dangerous work in hazardous circumstances."

D. J. Bird, a vice-chairman of Fisons Ltd., has retired from the company after 30 years' service. Mr. Bird, who is 65, has played a leading rôle in the affairs of the U.K. fertiliser industry during the last 30 years, and he has been a prominent figure in agriculture. During the war as Deputy Controller of the Fertiliser Control at the Ministry of Supply, he was responsible for the distribution and price of fertilisers throughout the country. Later he was appointed Controller of Miscellaneous Chemicals for the Government. These chemicals numbered more than a hundred, and all were vital to the war effort.

He was first elected President of the Fertiliser Manufacturers' Association in 1939, and on his return to Fisons after the war he was again elected to the F.M.A. Council, becoming President for the second time in 1946.

D. F. Haydon, chief technical sales representative of Baird and Tatlock (London) Ltd., and Hopkin and Williams Ltd., left England on March 17 for a six-week tour of the Middle East.

Robert D. Baird, B.A., E.R.D., has been appointed a director of Baird and Tatlock (London) Ltd., and of Hopkin and Williams Ltd.

He is a grandson of the founder of Baird and Tatlock (London) Ltd. He was educated at Winchester and Cambridge, where he read for the Mechanical Sciences Tripos. On leaving Cambridge, he joined the army in 1943. After demobilisation in 1946 he returned to Cambridge to take the Certificate in Education, and since 1947 he has been teaching mathematics at Eton College, where he is also the Careers Master.

Sir Ewart Smith, F.R.S., has retired from the board of I.C.I.

An engineer of distinction, Sir Ewart joined Synthetic Ammonia and Nitrates Ltd. (later the Billingham Division of I.C.I.) in 1923, just before the start-up of the first plant, and subsequently played a part in the major development of the Billingham complex, becoming its chief engineer in 1932. He was seconded to the Ministry of Supply in 1942 to be chief engineer and superintendent of armament design. He returned to I.C.I. in 1945, when he was appointed technical director, and was knighted for his wartime services in 1946. In 1955 he was appointed a Deputy Chairman of the company. Sir Ewart was chairman of the British Productivity Council in the early days following its formation, and has also served on numerous other bodies, governmental and scientific.

Sir Ewart does not intend to retire from active life. The Parliamentary Secretary to the Ministry of Health recently announced in the Commons that Sir Ewart had agreed to serve as chairman of a new council which has been set up to assist the application of modern industrial techniques in the National Health Service.

F. H. Taylor, for many years the sales manager (Pharmaceuticals) and southern representative of Whiffen and Sons Ltd. has been appointed sales manager for both industrial and pharmaceutical chemicals.

The Earl of Halsbury, who relinquished his position as managing director of the National Research Development Corporation at the end of March, has been made a Director of Sondes Place Research Institute.

R. T. Beasley has joined the B.T.L. group of companies as personnel manager. He has eight years' previous experience in personnel management, with Mobil Oil Co. (Coryton Refinery) and, before that, with the Watford Division of the Eastern Gas Board.

D. M. Boyd, a director of Fisons Ltd., has been elected chairman of the Association of Chemical and Allied Employers. He succeeds Sir Laurence Merriam, who retires after a two-year term of office.

Mr. Boyd has relinquished his duties as production director of the Fertilizer Division of Fisons, but he will remain a member of the Fertilizer Division board and continue as a director on the main board of Fisons.

J. S. Brough has joined Humphreys and Glasgow, Ltd. of London, from Monsanto Chemicals Ltd., where he was general manager of production. As technical director and general manager, he will act as deputy to G. G. Farthing, deputy chairman and managing director of Humphreys and Glasgow.

Mr. Brough will shortly complete a three-year term as a Member of Council of the Institution of Chemical Engineers and is chairman of Group A, British Conference on Automation and Computation.

The Distillers Co. (Biochemicals) Ltd. have made the following appointments: **J. M. Butters** is now manager, Export Sales Department (General); **W. G. Poole,** M.P.S., is manager, Export Sales Department (Specialities); **G. N. Henderson,** B.SC., M.R.C.V.S., is manager, Veterinary Department.

Mr. Butters will be responsible for sales of bulk drugs and certain of the company's branded medical products in oversea markets.

Mr. Poole qualified in New South Wales. Before joining D.C.(B).L. in 1955 he spent some years managing the Pakistan branch of Evans Medical Supplies Ltd.

Mr. Henderson will be in charge of development of the company's range of veterinary and animal feed products in both United Kingdom and oversea markets. Later this year he will represent the company at the International Veterinary Congress to be held in Madrid.

C. B Evans has been appointed to the board of Midland Silicones Ltd. He joined the company in 1955 as works manager of the company's plant at Barry in South Wales. He was previously with Peter Spence and Sons Ltd. and with I.C.I.

The Society Medal of the Society of Chemical Industry, which is awarded not more than once every two years for conspicuous services to applied chemistry or to the Society, has been awarded for 1959 to **Dr. Francis H. Carr,** C.B.E.

F. L. Waring, managing director of the "Coalite" Group of Companies, has been re-elected president of the Association of Tar Distillers for a second year. He has also been elected vice-chairman of the association of Chemical and Allied Employers, after six years as chairman of the Chemical Group.

Mr. G. C. R. Eley, chairman of British Drug Houses Ltd., has been appointed chairman of Richard Thomas and Baldwins in place of Sir Ernest Lever, who has retired after nearly 19 years as chairman. Mr. Eley is also a director of the Bank of England.

Obituary

R. S. Flexen, London representative of John Dore and Co. Ltd., chemical engineers died on April 1. Mr. F. W. Kendrick will be taking his place.

Gustav Gysin of Esrolka Ltd., Dubendorf, died on March 1, whilst on a business trip in Bahrain, Persian Gulf. He joined Esrolko in 1946, after spending 15 years in Colombo. He specialised in the company's export trade to the Near and Far East and Great Britain.

Flameproof clothing standards

B.S. 1547 : 1959—Flameproof industrial clothing (materials and design); B.S. 3119 : 1959—Method of test for flameproof materials; B.S. 3120 : 1959—Performance requirements of materials for flameproof clothing.

These three standards were published by the British Standards Institution last month, and relate to: (1) The requirements with which articles of industrial clothing must comply before they may be called "flameproof." (2) The performance requirements by which the flameproof qualities of materials may be judged. (3) The method of test which is to be employed in assessing these performance requirements.

I.C.I. spend more on research and development

Sales affected by organisational changes and under-capacity operation

I.C.I. spent £45·3 million on plant, equipment and buildings in the U.K. in 1958 and at the end of the year had authorised a further capital expenditure of £49·8 million of which £14·1 million had already been allocated to specific contracts. Among the more important projects authorised during the year were:

- The extension and modernisation of plant for the production of light soda ash at the Alkali Division's Lostock Works,
- a new plant in the General Chemical Division for the manufacture of calcium carbide,
- further development of the rock salt mine at Winsford,
- extension of the methanol plant at Heysham,
- a new nitric acid plant at Ardeer, and
- further development of the site and services of Wilton Works.

In 1958 expenditure on research amounted to £9·3 million compared with £8·5 million in 1957, and on development, including technical service, £5·7 million compared with £5 million in 1957.

These facts are given in I.C.I.'s annual report for 1958. Total Group sales fell slightly, from £462,887,826 to £462,677,074, and Group profits—more markedly—from £61,515,178 to £51,500,198.

These figures were affected by the formation of the subsidiary I.C.I. (Heavy Organic Chemicals) Ltd., which took over the Billingham Division's interests in organic chemicals, and the transfer to Yorkshire Imperial Metals Ltd., of the Metal Division's interests in the copper and copper alloy tube and plate industry. If the figures were adjusted to allow for these organisational changes, the strictly comparable figures for 1958 would exceed those of 1957 by about £10 million for Group sales.

Exports from the U.K. increased by nearly 2%, the total f.o.b. value amounting to £73·8 million.

A more important effect on profits than price fluctuations was the increase in costs caused by the operation of several plants below capacity. Initial expenditure on new plants also increased costs.

The total of I.C.I. employees in the U.K. fell by 3,738 partly because of redundancy but largely because of the transfer of some of the company's work to Yorkshire Imperial Metals.

During the year Plant Protection became a wholly-owned subsidiary when I.C.I. bought the £500,000 worth of shares in that company owned by Cooper, McDougall and Robertson Ltd.

Pharmaceutical Division. Three new products were introduced during 1958: *Lapudrine*, an antimalarial which is a more active derivative of *Paludrine*, *Etisul* a topical treatment for leprosy, and *Tenormal* for the treatment of hypertension. *Fluothane*, the fluorine-containing anæsthetic introduced in 1957, is now used in most British hospitals, and is selling well abroad, especially in the U.S. *Dictycide*, the injectable preparation for lungworm in animals, appears to have a bright future in the U.S., having passed that country's statutory tests. Export sales of *Savlon* preparations have increased.

Overseas. Europe is the biggest export market, taking £23·4 million worth of I.C.I. products. India, Pakistan, Ceylon and Burma took £9·2 million, Central and South America £7·8 million, Africa £8·1 million, Australia £8·8 million, Far East £7 million, North America £5·5 million and Middle East £4 million.

Local manufacture by overseas companies, mostly in the Commonwealth, continues to grow. Among the interesting smaller projects undertaken by I.C.I. is a five-year campaign for the Ghana Government against the capsid bug, which severely damages cocoa trees. *Gammalin* 20 is being supplied and local formulation of the spray should begin this year at Tema, 20 miles east of Accra.

MEETINGS

The Chemical Society

BIRMINGHAM

May 29. "Polyethers," by Prof. G. Gee. 7 p.m. Courtaulds Ltd., Coventry.

EXETER

May 22. "The Acetylenic Approach to the Synthesis of Natural Products," by Prof. R. A. Raphael. 5 p.m. Washington Singer Laboratories, Prince of Wales Road.

Society of Chemical Industry

CHEMICAL ENGINEERING GROUP

May 12. "Fuel Economy in Chemical Works," by W. Quick. 6 p.m. 14 Belgrave Square, London, S.W.1.

MICROBIOLOGY GROUP

June 4. Visit to Water Pollution Research Laboratories, Stevenage. 2 p.m.

FINE CHEMICALS GROUP

May 15. Annual general meeting. 6.30 p.m. "New Developments in the Chemistry of Emetine and Related Compounds," by Dr. H. T. Openshaw. 7 p.m. 14 Belgrave Square, London, S.W.1.

SOUTH WALES SECTION

May 15. Annual general meeting. 6.30 p.m. Royal Hotel, Cardiff.

News from Abroad

SOUTH AFRICA

Soda ash plant

A South African mining company—Federale Mynbou—is planning to set up a £2 million soda ash plant in the Transvaal which will make the Union independent of outside sources of this material. It will take the company between two and three years to develop the plant.

The savings in foreign exchange on present imports of soda ash would be well over £1 million a year, according to Mr. W. B. Coetzer, chairman of the company. The Union's present consumption of soda ash is between 70,000 and 75,000 tons annually. It is used in the manufacture of glass, soap, cattle dips, insecticides and has many other applications. Mynbou hope to buy land near the Sasol oil-from-coal plant. Salt will be drawn from pans at Port Elizabeth from which about 12,000 tons a year can be produced. Lime is available in the Johannesburg-Pretoria area.

HOLLAND

More synthetic glycerin

The capacity of Shell's synthetic glycerin plant at Pernis (Rotterdam) is to be increased to a minimum of 15,000 tons p.a. Production from the increased capacity is expected to become available early in 1960. The plant started up less than a year ago.

New antibiotics plant

A new pilot plant for antibiotics fermentation is now operating at the Delft factory of Koninklijke Nederlansche Gist-en Spiritusfabriek, N.V. Penicillin and streptomycin have been manufactured by the company for some time and production of *Pimaricin*, a new antifungal antibiotic developed by them, has now begun. In addition to antibiotics, similar fermentation methods are used for the production of riboflavin and for the microbiological conversion of steroids. Some organic synthetics for industrial and pharmaceutical use are also produced.

The pilot plant is housed in a four-storey building and has a total of 27 fermentors varying in size from 5 to 800 gal. The plant has been laid out with as many valves as possible located in two banks to simplify operation. All fermentors are made of stainless steel and are equipped with variable speed agitators, spargers and automatic temperature control. Nutrients and sterile antifoam can be added during the run without contamination.

The building contains two laboratories for analysis of products, and also houses offices and storerooms for raw materials and eqiupment.

GERMANY

New petroleum chemicals plant

The first four of a number of new petroleum chemical production units being built for Erdölchemie G.m.b.H. at Dormagen, near Cologne, have been commissioned. Erdölchemie is a jointly owned company in which the British Petroleum Co.'s German associate, BP Benzin und Petroleum A.G. and Farbenfabriken Bayer A.G. each have a 50% interest.

Ethylene and a variety of other gases used as basic chemical raw materials are being produced from a cracking plant and gas separation plant. Another cracking plant is being erected and the output of ethylene from both plants will total about 45,000 tons p.a. The major part of the ethylene produced will be transformed to ethylene oxide in two plants, the first of which has been commissioned. They will have a total capacity of about 36,000 tons p.a. of ethylene oxide, which is used, among other things, in the manufacture of synthetic resins and detergents. The balance of the ethylene will be used for the manufacture of synthetic ethyl alcohol.

A large part of the ethylene oxide produced is being processed in a glycols plant. The product from this plant may be used in the manufacture of anti-freeze, plastics and synthetic fibres. The high octane gasoline produced in the process is sold to BP's German marketing company.

Feedstock for the plants is at present being supplied from a variety of sources, but eventually will come from BP's refinery being built near Dinslaken.

UNITED STATES

Objections to tartrate tariff

Mr. Hans Stauffer, president of the Stauffer Chemical Co., has sent a telegram to President Eisenhower registering disappointment at his refusal to accept the Tariff Commission's recommendations that tariffs on tartaric acid and cream of tartar be adjusted to enable the industry to continue to exist.

It was stated in the telegram that this decision would eliminate the last remaining domestic source of tartar chemicals and would place consumers in the United States at the mercy of foreign producers.

Acid plant negotiations

Dixon International, of New Jersey, U.S.A., contemplates establishing a factory for the manufacture of sulphuric acid, muriatic acid, soda ash, caustic soda and other chemicals in Western Australia.

New Products

Musk substitute

Muscarol Extra, from Dragoco, is stated to be an effective substitute for genuine Tonquin musk which in many cases it can replace when well matured. For preparing musk tinctures the manufacturers recommend 75 mg. of *Muscarol Extra* to 925 mg. of 95% alcohol.

Oral antibiotic

Imperial Chemical Industries Ltd. (Pharmaceuticals Division) have added *Fulcin* to their range of medical products. This is the antibiotic griseofulvin, which is distinguished by its powerful antifungal properties. It has proved highly effective when given by the mouth as a systemic treatment for dermatophytic infections, particularly those of the skin, hair and nails which do not respond to topical medication. Clinical experience so far available indicates that a daily dose of 1 g. is adequate for most cases. In severe infections, 2 g. may be given initially to adults reducing to 1 g. when clinical response has occurred. *Fulcin* is presented in scored tablets of 250 mg., in containers of 100 and 1000, retail price 90s. each, trade price 51s. each and retail price 840s. each, trade price 560s. each, respectively.

Blood agar base

A single medium which is claimed to provide the essential nutrients for various pathogenic bacteria has been produced by Bell and Sons Ltd. They state that the medium not only fulfils the growth requirements but is also capable of producing colonies with typical characteristics which make recognition easy and simple, *i.e.* clear zones of hæmolysis in hæmolytic streptococci with lack of pigmentation, typical colonies in the pneumococci, and pigmentation in the staphylococci.

The substance, known as *Labacta*, is available as a blood agar base in the form of dehydrated granules which are said to be non-hygroscopic, to have an indefinite shelf life and a *p*H set at 7·4. It is further claimed that the medium is isotonic and is highly compatible with blood. It is also available without agar agar to replace meat, yeast and malt extracts and peptones in the manufacture of laboratory media.

Mouth and throat infections

Trillets brand lozenges are available from Burroughs Wellcome and Co. Each contains the antibiotic framycetin sulphate 1 mg., the analgesic lignocaine 2·5 mg., and a new antibacterial, halopenium chloride, 5 mg. They are said to destroy virtually all the bacteria found in sore throats and infections of the mouth. One lozenge sucked every ¼ hr. is adequate for this purpose.

Framycetin, an antibiotic claimed not to induce cross-resistance to those used systemically, is active against staphylococci, *H. influenzæ*, *H. catarrhalis* and *P. vulgaris*. Halopenium chloride, discovered at the Wellcome Research Laboratories, is almost completely non-toxic and is active against streptococci. It is fungistatic in the concentration used in *Trillets*.

The lozenges are stated to contain sufficient local analgesic to procure rapid alleviation of symptoms and to have a sialogogue base, the increased saliva carrying antibacterials and analgesic to the site of infection.

Trillets are issued in tubes of 15, price 2s. 6d., subject to the usual discount.

More palatable PAS

Sodium PAS is the basis of *Pasade*, the latest addition to the Smith and Nephew Pharmaceuticals Ltd. range of anti-T.B. drugs. *Pasade* sodium PAS granules have been designed to render sodium PAS more acceptable to patients. In the granules the sodium PAS is intimately mixed with a low melting point fat which, when swallowed, allows the granules to disintegrate, protecting the stomach lining against irritation. Subsequent emulsification of the fat within the intestine is said to ensure unimpeded absorption of the PAS leading to rapid and prolonged blood and tissue levels. The granules contain the equivalent of 96·4% sodium aminosalicylate B.P. and are packed in polythene—lined tins of 500 g. and 1,000 g.

Prices are: 500 g. granules 37s. trade, 55s. 6d. retail, 1,000 g. granules 70s. trade, 105s. retail, exempt from tax. Each tin contains a plastic measuring scoop.

Corticosteroid for dermatitis

A corticosteroid for topical dermatologic use has been developed at the Squibb Institute for Medical Research. The new preparation, a synthetic known as triamcinolone acetonide, will be made in ointment and lotion form and will be marketed under the trade names *Adcortyl-A* ointment and *Adcortyl-A Lotion with Graneodin*.

The ointment is presented in oleaginous *Plastibase* containing liquid petroleum and polyethylene. In addition to its corticosteroid content, the lotion includes *Graneodin*, a mixture of the antibiotics neomycin and gramicidin, for the treatment and prevention of superficial bacterial infections of the skin. Chemically, *Adcortyl-A* is: 9-alpha-fluoro-16-alpha, 17-alpha- dimethyl - methylenedioxy - 1,4 - pregnediene-3,20-dione.

According to Squibb the product has marked anti-inflammatory, antipruritic and anti-allergic properties.

Brush-on deodorant

Fram, a brush-on deodorant and anti-perspirant marketed by Pepsodent Ltd., is claimed to attack both Gram-positive and Gram-negative bacteria which develop on the human skin.

Mothproofing for all

Woollen goods can now be bought fully mothproofed. This development is the result of several years' research and testing by Shell Chemical Co. The new product, known as *Dielmoth*, is applied by the wool manufacturer at the processing stage and is therefore not suitable for domestic application. The process is relatively low in cost and is said to make economically possible the mothproofing of the full range of woollen goods. It is claimed that the product cannot be detected on the wool and mothproofed garments, nor is it affected by long wear or the effects of sunlight. If applied under certain conditions laid down by Shell, the mothproofing effect is maintained after repeated washing or dry cleaning, it is stated.

THE CHEMICAL MARKET

METHYLATED SPIRITS CHEAPER; ACETONE UP

LONDON.—Our price list will be printed in full next month. Here are this month's changes: **Methylated spirits** (industrial), 61 o.p., 500 gal. and upwards, is down 1s. 6½d. to 5s. 9½d. gal., 74 o.p., same quantity, is down 1s. 4½d. to 6s. 7d. gal. Prices per gal. for 10-gal. quantities are 6s. and 6s. 9½d. respectively. **Red mercury oxide B.P.C.** has decreased by 1s. 3d. to £1 7s. 1d. per lb. in 28 lb. lots, and **silver nitrate** by ½d. to 5s. 1½d. per oz. in 500 g. lots. **Acetone**, 40-45 gal. drums in 10-ton lots, has increased by £5 to £93 per ton, while **dimethyl sulphate** in 400 lb. drum lots has increased by 2s. to 3s. 8d. per lb. **Benzyl benzoate** is also up by 1s. 8d. to 7s. 2d. per lb. **Beeswax** has reduced in price. Dar-es-Salaam spot is down by £1 to £26 per cwt., Sudan spot by £1 to £24 per cwt. and refined yellow by £1 10s. to £26 per cwt. **Carnauba** fatty grey has increased by £1 10s. to £30 10s. per cwt. **Gum arabic** lump is up by £1 5s. to £8 10s. per cwt. and **Karaya** powder by 2d. to 3s. 8d. per lb. **Agar agar** has also increased, Kobe strip by 2s. 3d. to 13s. 6d. per lb. and powder by 2s. 6d. to 17s. 6d. per lb. **Palm kernel oil** has increased by £9 to £156 per ton and **palm oil** by £6 to £114 per ton.

Packaging

Economical aerosol

Solvolene Lubricants Ltd. produce an aerosol stated to contain 100% pure silicone. Packed in a 16 fl. oz. industrial aerosol container, it may be used as a mould release agent, lubricant and general purpose anti-stick compound.

★

Fibre drums for liquids

Fibre drums available for liquids of many kinds, including acids, are claimed to be robust and light and easy to handle. Included in the range is the *Polykask 5B*. This has a polythene inner container fitted with a retractable rubber spout which, it is said, enables the bung to fit snugly and flush with the top. A metal reinforced indentation in the bottom of the cask accommodates the handle of the cask beneath when stacked. Both ends are banded with rolled steel rims.

The manufacturers, Bowater-Eburite Bulk Packaging Ltd., also make *Supakasks* for pastes and semi-liquids. These are said to be suitable for products with viscosities above 5,000 centipoises, and several versions are available, either with laminated linings of polythene or foil, or with a full open-top semi-rigid polythene liner. A lever action closure which is said to ensure an air-tight joint is optional at slight extra cost.

★

Thermosetting polyester film tapes

Permacel Tapes Ltd., a newly formed subsidiary of Johnson and Johnson (Gt. Britain) Ltd., have added two new products to their range of pressure sensitive tapes. These are *Permacel* 62 (transparent) and 621 (*Orange*) *Melinex** thermosetting electrical tapes. The high heat stability provided by the backing, combined with the type of adhesive used, is claimed to make these tapes suitable for use where continuous high operating temperatures of up to 150°C. are encountered.

Both tapes are manufactured from 100 gauge polyester film spread with an electrical grade thermosetting adhesive which, in its uncured state, has excellent pressure sensitive characteristics. After cure at a given cycle, the tape becomes bonded to the surface to which it has been applied, rendering it resistant to attacks of paint and varnish solvents and most transformer oils. The waterproof backing is said to be highly resistant to acids, chemicals and alkalis.

* *Melinex* is the I.C.I. Ltd., trade mark for polyester film.

Automatic aluminium can-making plant for the John Dale aerosol range.

Making aluminium aerosol cans automatically

John Dale (Bury) Ltd. have laid down an automatic line for the manufacture of various types of aluminium aerosol cans and similar containers. Up till now conventional methods of can manufacture have, of necessity, included a high proportion of hand labour in transferring the can from one station of manufacture to the next—with the resultant slow down in production rate and increase in cost of the individual can.

The new automatic line is claimed to do much to overcome these difficulties. The first part of the line, on the ground floor of the factory, consists of:

(1) The press—extruding can bodies
(2) The trimming machine—removing surplus aluminium
(3) The flange and beading machine—sizing (lengthwise), flanging and beading the can to customers' individual requirements.

These operations are synchronised by conveyors to enable the can to move at a uniform speed to the next operation, degreasing, which takes place on the first floor.

Conveyance to the degreaser is by automatic feed from beading machine to biplanar chain. This latter is 110 ft. long and makes a complete cycle from flanging through the degreasing plant, returning empty to flanging plant on the ground floor where it is reloaded with cans for degreasing.

After degreasing, the cans are offloaded on to another conveyor feeding an automatic enamelling or base coating machine. At this conveyor stage, the cans, if necessary, can be shed to an internal coating line for araldite coating and stoving, and then returned to the enamel coating machine. This arrangement is necessary due to the wide variation in stoving temperature required between internal coating materials and epikote enamels used for external decoration.

After the external enamel coating has been applied automatically, the cans are conveyed through electric infra-red stoving ovens to enable the first part of the enamel curing operation to take effect. The cans are then ready to receive the necessary print decoration, which is done by four-colour offset printing machines. The cans are automatically transferred from the oven chain conveyor to the print turret which rotates, synchronising with the first stoving oven conveyor. Following the actual printing operation the cans are given a final stoving to dry the printing ink, and finally cure the base coat enamel.

The cans are then automatically transferred from the second oven chain conveyor to a further conveyor feeding a seaming machine which, as the final operation, seams a metal base on the flange of the aluminium can.

★

Plastic bottles

E. R. Holloway Sales Ltd. have introduced three plastic bottles of the Winchester style, (16, 20 and 40-oz. sizes) in thin wall hard polythene. These are said to combine lightness, shatterproof qualities and freighting economies with a more rigid feel and increased resistance to some "doubtful" chemicals. The price of the 20-oz. bottle complete with cap is approximately 9d. through the normal wholesale channels.

NEW TRADE MARKS

APPLICATIONS

Pharmaceuticals

VASAKIN.—781,913. *Chemical, Industrial and Pharmaceutical Laboratories Ltd.*

SPECTRODERM.—782,035. *Agprolin Ltd.*

MITODERM.—782,036. *Agprolin Ltd.*

PREADIL.—783,068. *Chas. Pfizer and Co. Inc.*

TRALGON.—753,006. *E. R. Squibb and Sons Ltd.*

REVLON.—760,475. *Revlon Inc.*

STERIFLEX.—773,201. *Allen and Hanburys Ltd.*

NEBIDOSAN.—781,296. *Winthrop Products Ltd.*

TALAKT.—781,297. *Winthrop Products Ltd.*

COCCIVAC.—781,298. *Winthrop Products Ltd.*

SAFFELAM.—782,580. *Glaxo Laboratories Ltd.*

VALROSA.—782,652. *The International Import and Export Corporation Ltd.*

ESIDREX.—782,734. *Ciba Ltd.*

TABLONGETS. — 783,156. *C. H. Boehringer Sohn.*

SEVANDIL.—772,112. *A/B Pharmacia.*

FO-TI TIENG.—775,695. *P. de Berenger-Layman.*

BECTA.—776,893. *D.D.D. Co. Ltd.*

ASPIMYCIN. — 780,643. *Farbenfabriken Bayer A.G.*

ASPIVITAL. — 780,645. *Farbenfabriken Bayer A.G.*

ORATENSIN. — 781,270. *Imperial Chemical Industries Ltd.*

FERRIMAX.—B781,399. *Osmond and Sons Ltd.*

DISVAX.—781,499. *Willows Francis Ltd.*

COMITAL.—781,782. *Farbenfabriken Bayer A.G.*

CEPRHDINE.—782,331. *Macleans Ltd.*

CEPYRIDE.—782,333. *Macleans Ltd.*

PACINOL.—782,424. *Harker Stagg Ltd.*

ISMELIN.—783,130. *Ciba Ltd.*

MELLERIL.—783,731. *Sandoz Products Ltd.*

DI-ALMINATE.—774,097. *Bristol-Myers Co.*

ZACTANE.—775,117. *American Home Products Corp.*

CHLORAMEX.—777,892. *A/S Dumex.*

LOROL.—778,080. *Ronsheim and Moore Ltd.*

DOSISPRA.—B779,481. *C. H. Boehringer Sohn.*

UCAL FOR TYPLUS. — 780,355. *United Chemists Association Ltd.*

BULGURT.—780,416. *Svenska A/B Remedia.*

DOVAX.—781,500. *Willows Francis Ltd.*

NIDIKEL.—782,326. *Parke Davis and Co.*

DIMMICEL.—782,327. *Parke Davis and Co.*

NAUTIBERON.—783,771. *C. H. Boehringer Sohn.*

NEW COMPANIES

These particulars of new companies have been extracted from the daily register of Jordan and Sons Ltd., company registration agents, Chancery Lane, London, W.C. 2.

Chigwell Chemists Ltd. 13.2.59. 12 Norfolk Street, London, W.C.2. £100. Dirs.: H. and Ann S. Zilesnick.

Du Lundi (London) Ltd. 13.2.59. 13 Buckingham Palace Gardens, London, S.W.1. Chemists. £1,000. Dirs.: H. S. and J. C. Q. Coaker, R. R. Howell and L. Stusser.

F. W. Wiles Ltd. 16.2.59. 1a Dynevor Road, Stoke Newington, London, N.16. To take over bus. of Hart and Co., cd. on at Dynevor Road, Stoke Newington, to carry on bus. of mnfrs. of and dlrs. in chemicals, gases, drugs, etc. £1,000. Dirs.: F. W. and Rebecca Wiles.

Lea Bridge Drug Stores Ltd. 18.2.59. 9 Warwick Court, High Holborn, London, W.C.1. £100. Dirs.: not named.

E. C. Sleep (Heathfield) Ltd. 19.2.59. 231 London Road, Waterlooville, Hants. Chemists. £1,000. Dirs.: E. C. and Jessie Sleep.

Winn Reece and Co. Ltd. 23.2.59. 465 Roman Road, Bow, London, E.3. Chemists. £100. Dirs.: not named.

E. L. Burgon (Chemists) Ltd. 23.2.59. 3 Fidlas Road, Llanishen, Cardiff. £1,000. Permnt. dirs.: G. M. and Ethel L. Jones.

T. H. Turnbull (Chemists) Ltd. 23.2.59. 104 Mansfield Road, Sheffield 12. £1,000. Permnt. dirs.: T. H. and Mrs. Anne Turnbull.

Landy's (Chemists) Ltd. 24.2.59. 100 Gt. Portland Street, London, W.1. £100. Dirs.: A. and M. Landy.

NEW PATENTS

COMPLETE SPECIFICATIONS ACCEPTED

Detergents

Detergent compositions. *T. Hedley and Co. Ltd.* 811,902; 812,249.

Coloured detergents or washing adjuvants. *Henkel and Cie. G.m.b.H.* 811,028.

Detergent compositions and processes for the manufacture of detergent compositions. *Veb Fettchemie*, formerly *Veb Fettchemie und Fewa-Werk.* 811,732.

Detergent compositions. *Henkel-Helios A.B.* 810,151.

Vitamins

Process for the simultaneous production of refined shark liver oil and vitamin A concentrates along with the recovery of other therapeutically active by-products. *S. Mahdihassan, M. Moinuddin, S. M. Ali, and S. A. Haq.* 810,643.

Bio-synthesis of vitamins. *Aschaffenburger Zellstoffwerke A.G.* 811,874.

Production of compounds of the vitamin-A series. *Badische Anilin- and Soda-Fabrik A.G.* 811,697.

Manufacture of carotenoids. *Hoffmann-La Roche and Co. A.G.* 812,267

Fungicides, pesticides

Esters of monothiphosphoric acid, process for preparation thereof and insecticidal compositions containing them. *Sandoz Ltd.* 812,369.

Fungicidal compositions. *Imperial Chemical Industries Ltd.* 810,377.

Fungicidal compositions containing griseofulvin. *Imperial Chemical Industries Ltd.* 810,378.

Dithiophosphoric acid esters and insecticidal preparations comprising them. *Sandoz Ltd.* 812,119.

Substituted umbelliferone esters of thiophosphoric acids and pesticidal compositions containing them. *Montecatini Soc. Generale per L'Industria Mineraria e Chimica.* 811,644.

N-morpholyl-substituted ketones with fungicidal action and a process for production thereof. *Farmaceutici Italia S.A.* 810,497.

Fungicides. *Farbenfabriken Bayer A.G.* 810,044.

Odour removal and stabilisation of phosphate-containing pesticides. *American Cyanamid Co.* 812,182.

New patents are from the *Journal of Patents*, and new trade marks are from the *Trade Marks Journal*. In each case permission to publish has been given by the controller of Her Majesty's Stationery Office. Each of the publications mentioned is obtainable from the Patent Office, 26 Southampton Buildings, London, W.C.2.

Sixty-Five Years Ago

From MANUFACTURING CHEMIST

May 1894

Ragwort

Ragwort is powerfully deodorant, alterative, antiscorbutic, astringent, detergent; but the plant is usually employed externally, the preparations used being the expressed juice, an ointment prepared from the fresh plant, and a fluid extract or decoction.

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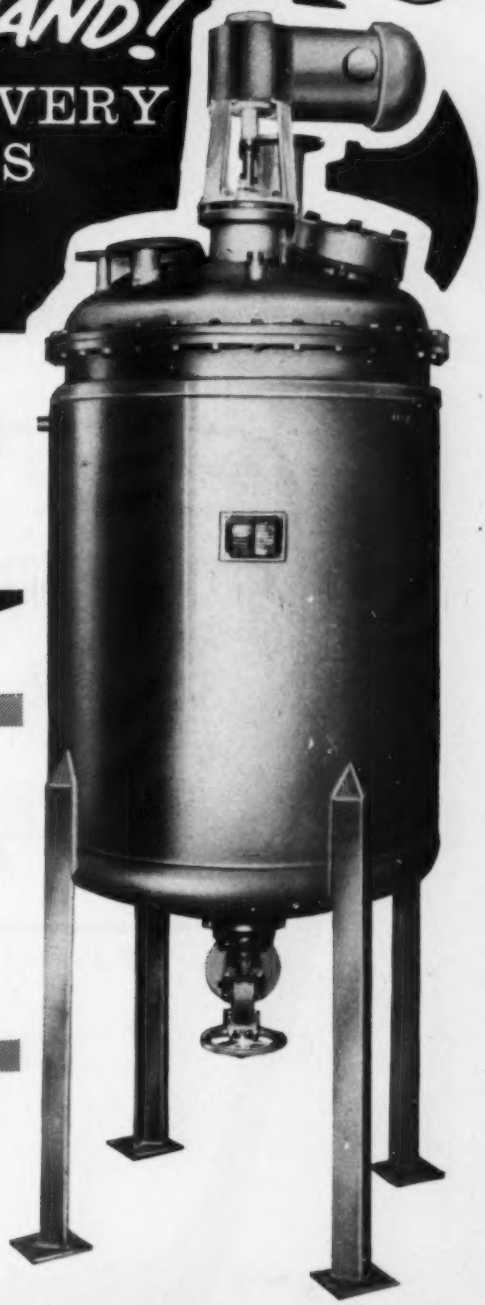

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"Out of sight  out of mind"

"Too many cooks spoil the broth" 

"Many hands  make light work"

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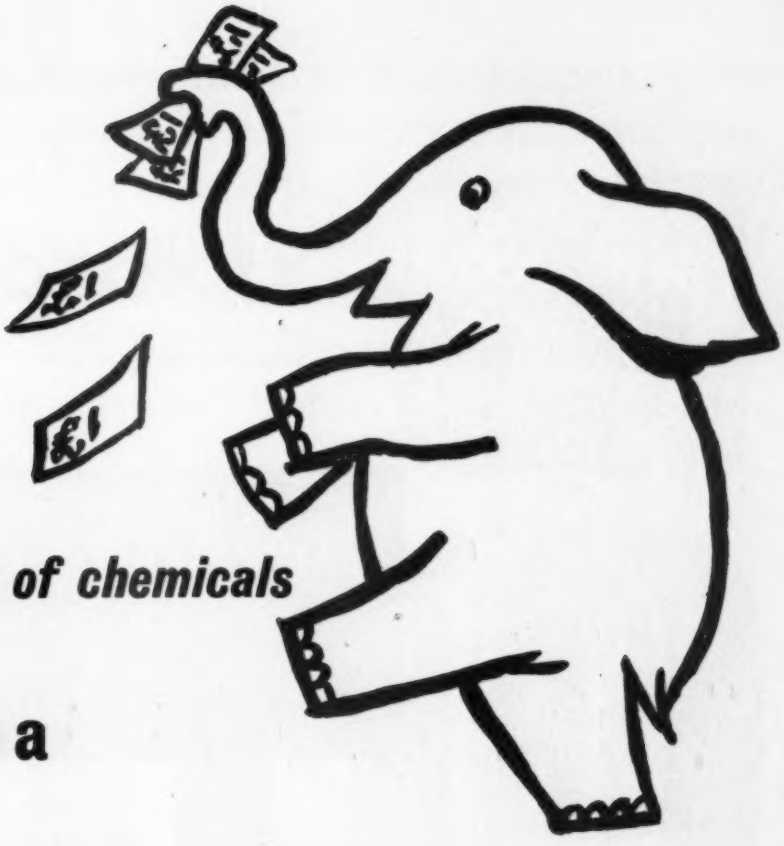
B.W. & CO. FINE CHEMICALS

BURROUGHS WELLCOME & CO. *(The Wellcome Foundation Ltd.)* LONDON



In the processing of chemicals

You may have a

costly "White Elephant"—and not know it

Your present processing plant may appear to be adequate for your production needs. But remember, the *right* machine needs no more space, or labour, or power than a machine which is producing say only 75% of a possible potential.

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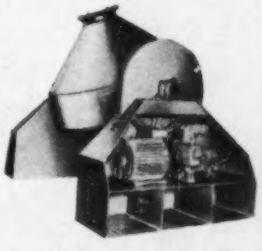
For blending dry products which are liable to damage if treated in a trough type mixer with internal agitator. No mixing blades or vanes are required as complete blending is obtained by the combined rolling and folding motions of the material.



"RAPID" SIFTER-MIXER AND SPRAYER

For adding liquids, perfumes, flavourings, etc., to dry materials during mixing. Brush, sieve and agitator easily removed without disturbing drives, leaving whole of interior clear for cleaning

Send for illustrated folder of 22 types of machines

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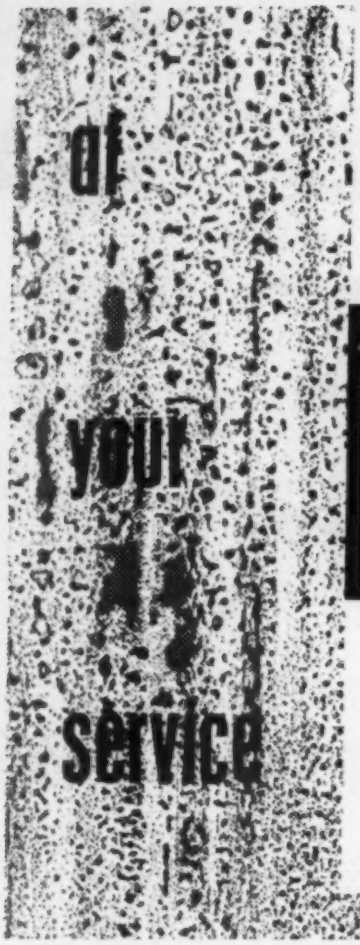
London Office: 1 ALBEMARLE STREET, LONDON, W.1. *Telephone: Grosvenor 8206*



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Cetomacrogol 1000 B.P.C. and allied non-ionic Emulsifiers and Dispersants.

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Cetrimide B.P. and related Quaternary Ammonium Bactericides.

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Cetomacrogol Wax B.P.C. Emulsifying Wax B.P. and related Emulsifying Waxes.

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Alkylolamides.

GCL

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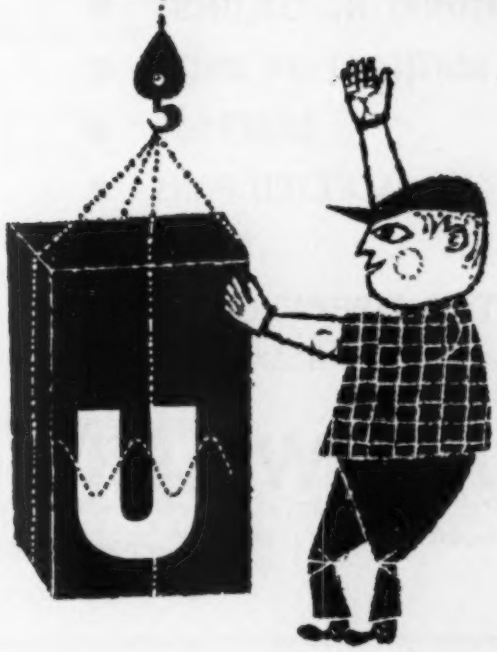
WORTLEY LOW MILLS, LEEDS 12.
Tel: LEEDS 63-7847/8/9 Grams: "GLOKEM Leeds"

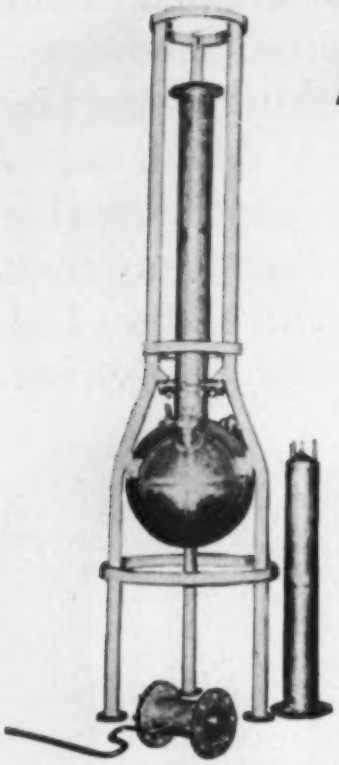
The thousandth Rapisonic has been shipped to our American sister company. The new ultrasonic homogenisation technique has been accepted within six years by eighteen industries in fourteen countries. Make use of the experience of an enthusiastic and knowledgeable team of specialists to help you with the homogenisation of emulsions and dispersions. Contact Ultrasonics Ltd. at Westgate, Otley, Yorkshire. Telephone Otley 3221.

1000



Ultrasonics Ltd

CHEMICAL PLANT AND EQUIPMENT



25 gallon S/S Still specially designed for the Essential Oil Trade, unit complete with Column Condenser, etc.

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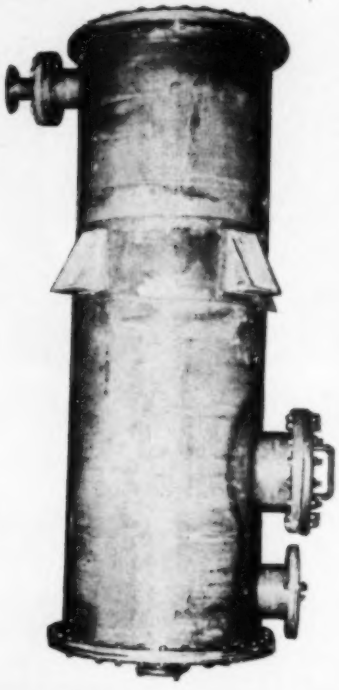

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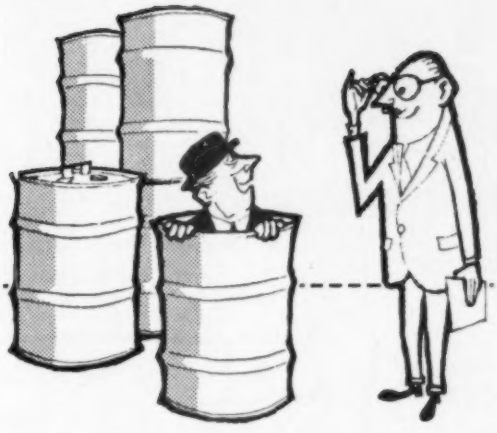
Telephone: MARyland 5818 (3 lines)



If the product needs a metal pack...
It pays to deal with READS

Do you manufacture tins, cans, kegs and drums for everything?
Well, perhaps not everything, but certainly containers for most liquids—acids, oils, chemicals, paints and liquid foods, are only a few.

What about tin boxes for sweets, dyestuffs and food?
Those too! The Reads' range of containers is comprehensive.

Which leads me to another point. Do you make containers to customer's specifications?
Yes indeed. Our packaging service experts are always ready to talk it over with the customer about the sort of container which will give the best value. And what's more we're always on call to help out with his printing problems.

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Yes, I'm beginning to understand why you've been at the top for nearly 100 years. Now I've got a problem...

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READS OF LIVERPOOL are always at your service

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The Bag on the right of the illustration was sealed by the unique "STICLA" versatile high-speed adhesive bag-sealer

the "STICLA" adhesive method for profit-happy packaging.

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POLYTHENE BAGS
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MULTIWALL PAPER BAGS

Entirely British made and designed
British and Foreign patents pending

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STICLA SEALER

PAYS FOR ITSELF in a SHORT TIME!

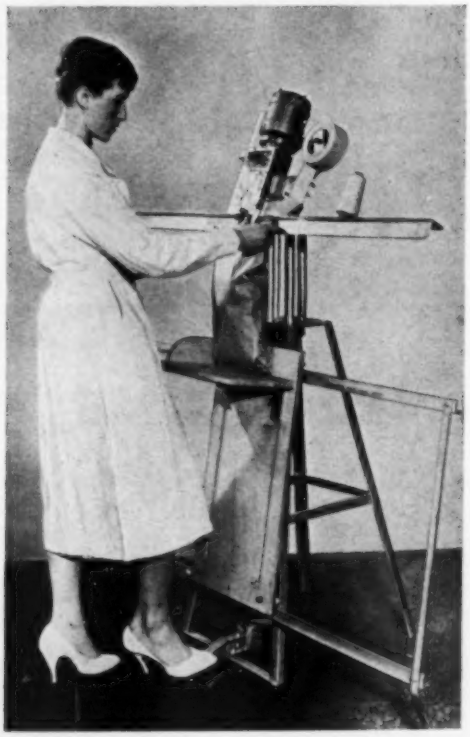
(1) **Saves container material, reducing costs, eliminating bunching.**

(2) **Seals *any* weight and size polythene film bags or paper bags to a maximum length of 40" when filled.**

(3) **"Sticla" produces a *hermetically sealed* container, stronger than the surrounding material.**

(4) **Rip cord goes through seal, pull one end, bag opens,**

(5) **"Sticla" made of sturdy steel, economical to run.**



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Which Package is Selling Your Product?

The Bag on the right of the illustration was sealed by the unique "STICLA" versatile high-speed adhesive bag-sealer

← *the "STICLA" adhesive method for profit-happy packaging.*

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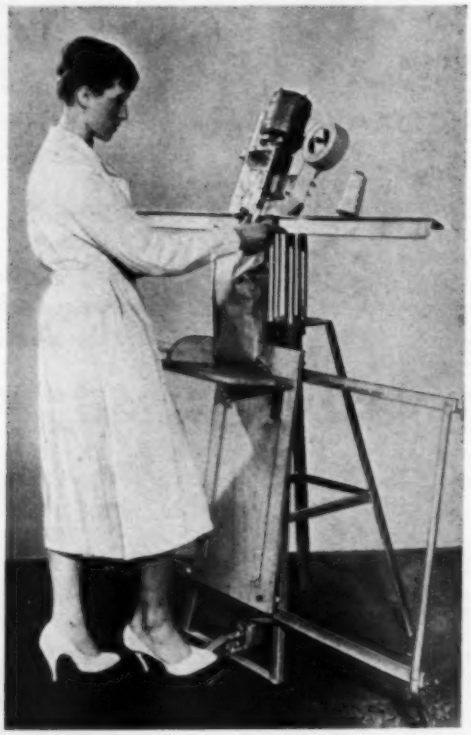
(5) **"Sticla" made of sturdy steel, economical to run.**



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Containing 40% of Thioglycollic Acid

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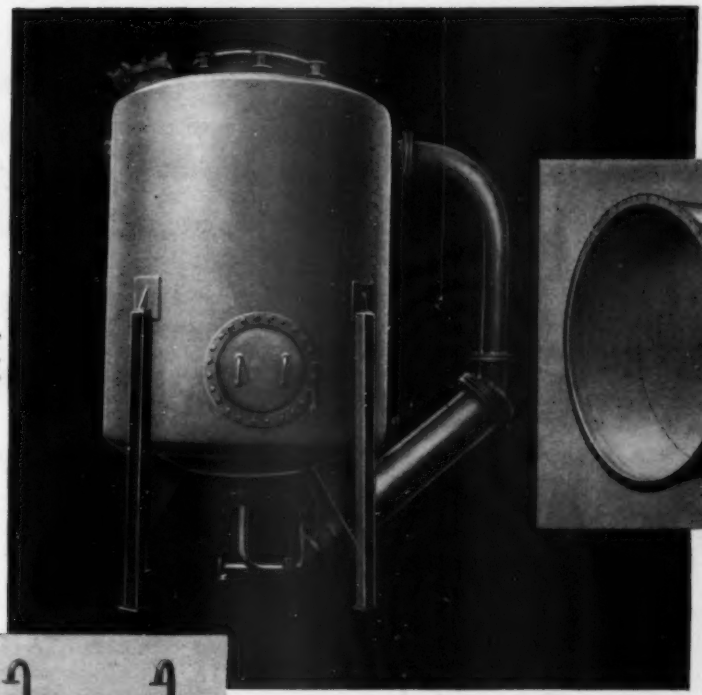
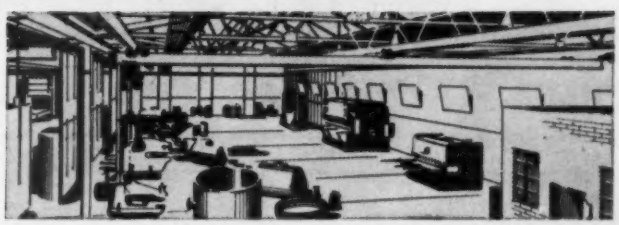
M-W.69



1,000 gall. kettle in ¼" copper. Lynx Quasi-arc welded.

Stainless steel vessel with mild steel jacket

12,000 gallon water separator



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BC4

Bet you my Dad's factory uses more acetone than your Dad's.

Bet you it doesn't! My Dad's factory
uses simply tons and tons and tons of acetone.
And it all comes from Shell Chemical, so there!

Golly! My Dad's acetone comes from Shell, too.
I say . . . like a bullseye?

SHELL CHEMICAL COMPANY LIMITED

In association with Petrochemicals Limited and Styrene Products Limited

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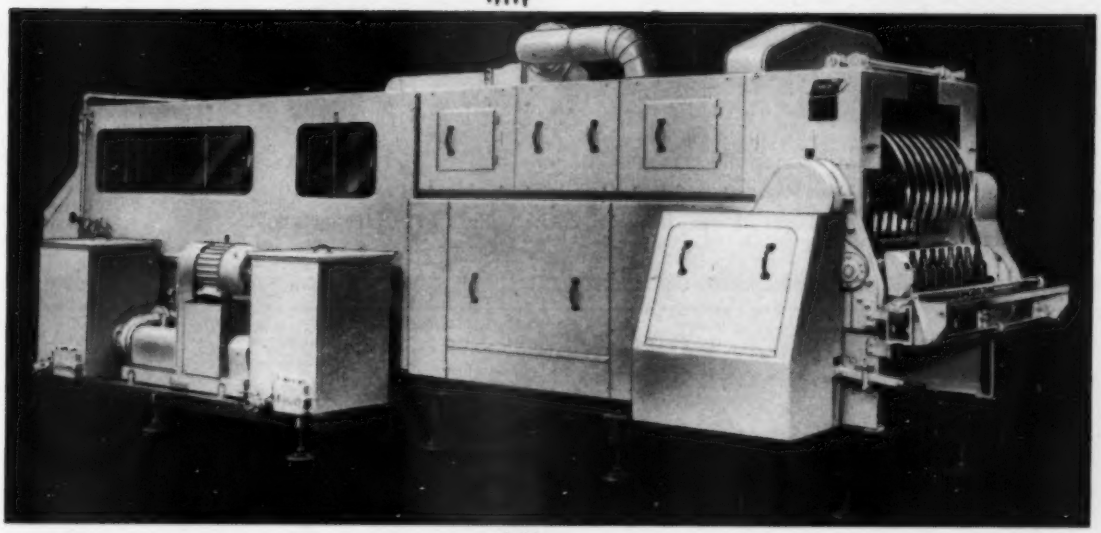
SA.3

A set of these advertisements is available free on request from any of the offices listed above.

Leave no room for doubt...

You cannot afford to leave any room for doubt when it comes to bottle cleaning, and there is nothing that does it better or safer than a good jetted wash.

The powerful action of strong jetting, with the help of detergents or without, removes all foreign matter and gives the bottles a sparkling freshness that does justice to their contents whatever they may be.



Illustrated is a Dawson New Junior with a drying section, available in a range of sizes to handle from 1,800 to 6,000 bottles per hour.
Full details of this machine and others with greater and smaller capacities will be supplied on request.

..use DAWSON Bottlewashers

DAWSON BROS. LTD. Gomersal near Leeds

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LONDON WORKS: 406 Roding Lane South • Woodford Green • Essex

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Have your Product Manufactured in the

CENTRAL AFRICAN FEDERATION

CENTRAL AFRICAN PHARMACEUTICALS (P.V.T.) LTD.

CHEMICAL & MANUFACTURING DIVISION

can now accept contracts for the manufacture of: *PHARMACEUTICALS—TOILET PREPARATIONS—HOUSEHOLD COMMODITIES* and *ALLIED PRODUCTS*—in their Salisbury factory.

Local Production will put your product in a strong position in this rapidly expanding market.

Market Surveys and Efficient Distribution can also be effected by the Company's various marketing divisions.

Director available London for personal interviews 14th May onwards. Write **Box 2279, Salisbury, Southern Rhodesia.** or c/o **Goode, Durrant and Murray Ltd., Durrant House, Chiswell Street, London, E.C.1. Phone: MONarch 4090.**

BAKER PLATINUM

deoxo

Catalytic Gas Purification Process

The "Deoxo" Process provides for the catalytic hydrogenation or oxidation of certain gases. Various types of laboratory and commercial Purifiers have been developed embodying the "Deoxo" Process and using different Baker Catalysts. For example—MODEL D for the removal of oxygen from hydrogen. Can also be used for the removal of oxygen or hydrogen from other industrial gases. MODEL E for converting small quantities of carbon monoxide to methane in a hydrogen rich atmosphere. MODEL M for the catalytic combination of oxygen and carbon monoxide to form carbon dioxide. Also the catalytic oxidation of hydrogen in an oxygen rich gas. MODEL P is designed to provide for the catalytic combination of oxygen and hydrogen in gases containing carbon monoxide. The principle advantage of the "Deoxo" process is that, with negligible operating costs, a very high degree of purification can be achieved—in some cases the remaining impurity being less than 1 v.p.m. (0.0001%).

Model D — 1000 c.f.h.

Model M — 200 c.f.h.

Model D — 5 c.f.h.

ENGELHARD INDUSTRIES, LTD.

BAKER PLATINUM DIVISION

52 HIGH HOLBORN, LONDON, W.C.1. *CHAncery 8711*

* *A copy of the illustrated publication, giving full details of the "Deoxo" process, will be forwarded on application. Technical representatives are always available for consultation and advice.*

Tough— but so pure

Made from virgin spruce fibre, SCANDINAVIAN folding box board is as pure as any you'll find this side of Paradise. There is no inferior or repulped material in its make-up, therefore it can be used with complete confidence for the packaging of sensitive products—i.e., those which are liable to pick up taint by taste or odour. SCANDINAVIAN is hygienic yet tough enough for most practical purposes. It combines the properties of whiteness and lightness with remarkable rigidity and an excellent printing surface. Save yourself a search by writing for details of SCANDINAVIAN now.

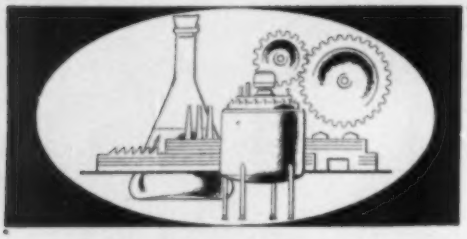
SCANDINAVIAN

PURE FOLDING BOX BOARD

'SCANDINAVIAN' PACKING FOR SENSITIVE PRODUCTS
The name 'Scandinavian' guarantees a pure folding box board produced by the associated box board manufacturers of Finland, Norway and Sweden.

Ask your boxmaker or agents of the FINNISH, NORWEGIAN AND SWEDISH FOLDING BOX BOARD MILLS OR WRITE TO THE INFORMATION DEPT., P.O. BOX 7232, STOCKHOLM 7

CVS-19



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a key factor in many new processes

Complete technical information concerning the hydrides listed below is available to you, without obligation.

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Lithium Aluminium Hydride—Reducing agent for organic acids, esters, ketones, aldehydes and acid chlorides.

Sodium Borohydride—Reducing agent aldehydes, ketones, acids, acid anhydrides and other functional groups.

Potassium Borohydride—Reducing agent for carbonyl groups of aldehydes, ketones, acid halides and esters.

Sodium Hydride—Condensing agent for Claisen, Dieckmann, Stobbe, nitrile and acetoacetic condensations. Reduction of metal halides to metal.

Calcium Hydride—Reducing agent for inorganic oxides, drying agent, source of hydrogen.

Methyl Borate—Non-aqueous liquid, neutron shield; starting material for boron chemicals.

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Titanium Hydride—Brazing agent in ceramic-ceramic and ceramic-metal seals. In copper and nickel alloys, yields age-hardening properties.

Zirconium Hydride—Electronic getter, alloying agent in powder metallurgy, ingredient in pyrotechnic composition.

Titanium and Zirconium Alloys—As both master alloy and as powder are used in magnetic materials and high temperature alloys.

Thorium—Electronic and atomic energy application.

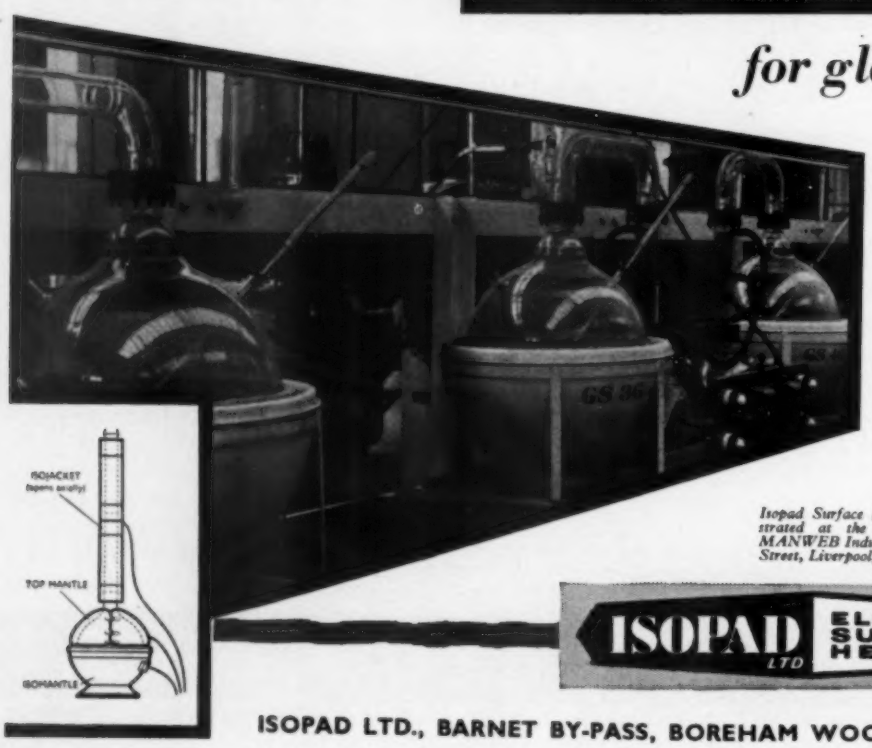
Chromium-Nickel Alloy Powder—In powder metallurgy, as additive to iron powder parts for high strength properties.

manufactured by **Metal Hydrides Incorporated, Beverly, Massachusetts, U.S.A.**

Represented by: **London & Scandinavian Metallurgical Co. Ltd., 39-41 Hill Road, Wimbledon, London, S.W.18, England.**
A. B. Supplator, Box 16150, Stockholm 16, Sweden. **Metalchimica, S.P.A., Via Stampatori 21, Torino, Italy**

ISOMANTLES

for glass flasks and columns



Isomantles are made for glass flasks of all sizes including 200 L. With Isojackets for the column and manual or automatic control, you can rely on trouble-free heating of your glass plant to any required temperature.

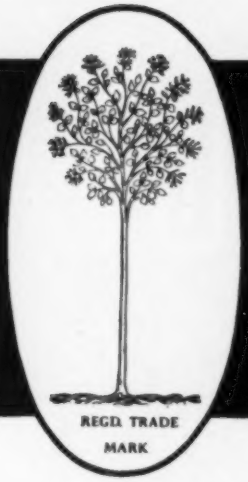
★ **Flameproof range now covers 1 L. to 200 L.!**

Send for Catalogue LM describing Isomantles for glass plant, and 44-page catalogue dealing with Industrial Electric Surface Heaters.

Isopad Surface Heating Equipment will be demonstrated at the 2,000 square feet exhibition at MANWEB Industrial Development Centre, Paradise Street, Liverpool, 20th to 29th May.

ISOPAD LTD ELECTRIC SURFACE HEATERS

ISOPAD LTD., BARNET BY-PASS, BOREHAM WOOD, HERTS. **Tel: Elstree 2817/9**



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ESTABLISHED 1911

MANUFACTURED AT OUR WELWYN GARDEN CITY FACTORY

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B.P.C.

The modern treatment for worm infestation in medical and veterinary practice

Piperazine Adipate
Piperazine Citrate
Piperazine Diacetate
Piperazine Hydrochloride
Piperazine Dihydrochloride
Piperazine Phosphate
Piperazine Sulphate
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CAN ALSO BE SUPPLIED IN TABLET & ELIXIR FORM

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CARNEGIES OF WELWYN LIMITED

Manufacturers of Fine Chemicals **WELWYN GARDEN CITY · ENGLAND**

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ONLY CLEAN AIR FOR CARRERAS

this Hyster Monomast truck—powered by L.P. gas*—operates INSIDE Carreras air-conditioned cigarette factory and doesn't contaminate tobacco

Hyster Fork Lift Trucks—powered by L.P. gas—with no noxious exhaust fumes are revolutionising handling methods and slashing costs in many different industries.

Ask for details without obligation.

*Bottogas distributed by Shell-Mex and BP Gases Limited.

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HANDLING EQUIPMENT

moves more for your money

sold and serviced by :
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Excellent adhesion to difficult surfaces such as moisture-proof film, metal and plastic containers. Increased production. Elimination of extra cleaning and polishing processes. Entire absence of gum exudation. All over label adhesion.

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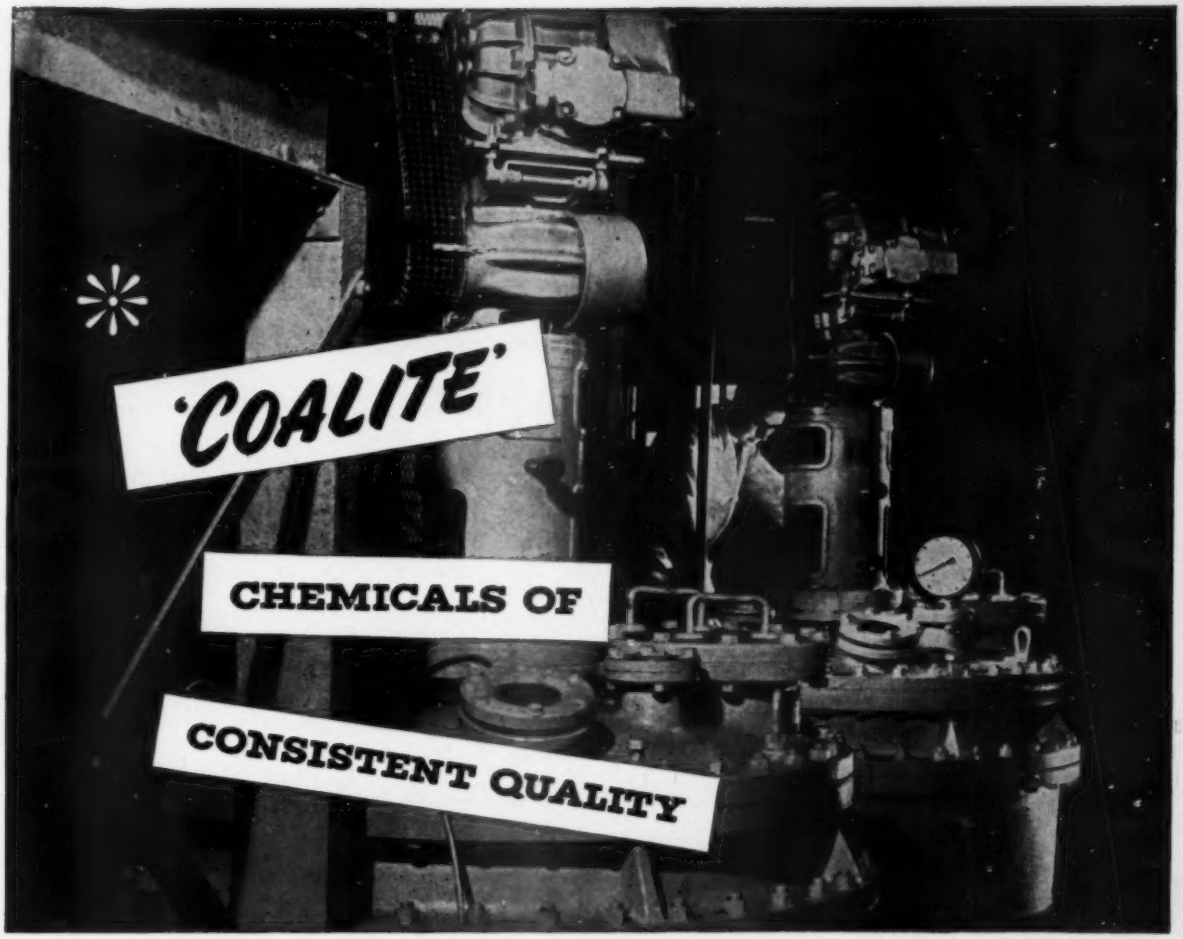

Glass-lined equipment and careful supervision ensure that the "Coalite" Chemicals you receive maintain their consistent high standard of purity.

CHLORINATED PHENOLIC COMPOUNDS

2 : 4 Dichlorophenol.
2 : 4 : 6 Trichlorophenol.
Para Chloro Ortho Cresol.
6. Chloro Ortho Cresol.
Dichloro Meta Xylenol (D.C.M.X.)
Chlorinated Xylenols.
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HIGH BOILING TAR ACIDS

including white emulsion grades for use in high quality disinfectant fluids.

FULL RANGE OF CRESYLIC ACIDS

including : Phenol • Ortho Cresol • Meta/Para Cresol • Xylenols—blended to consumers requirements.

DIHYDRIC PHENOLS

including Catechol, Tertiary Butyl Catechol, Methyl Catechols and Methyl Resorcinols.

COALITE AND CHEMICAL PRODUCTS LTD

CHESTERFIELD . DERBYSHIRE *Telephone :* BOLSOVER 2281/6

Your enquiries are welcomed and literature describing the 'Coalite' range of products is available on request.

McN. 760

Bottles by the Million

Lacrinoid Standard Bottles and Carboys are made in over *sixty* different types. They range from 10 cc. to 60 litres—in other words, the largest is *six thousand times bigger than the smallest*. That's the Lacrinoid Standard Range for you!

Write for more details of the standard range of containers, most of which are also available in thin-wall thicknesses at very attractive prices*

LACRINOID
TRADE MARK

Lacrinoid Products Ltd., Gidea Park, Essex
Telephone: Hornchurch 52525

* If you manufacture a liquid product that needs *eye-appeal*, ask for particulars of Lacrinoid *PURPOSE-MADE* BOTTLES. The product designer is at your disposal.

PLENTY ★ ★ ★

for PUMPS
MIXERS
FILTERS

AND COMPLETE
CHEMICAL PLANT

ILLUSTRATED: *A stainless mixing vessel with special turbine head, designed for electric jacket heating (not shown). Part of a complete process plant designed, manufactured and installed at Autoclean Ltd., London factory.*

PLENTY & SON Ltd.

Eagle Iron Works

NEWBURY, Berks, England

Telephone: NEWBURY 2363 (4 lines)
Telegrams: PLENTY, NEWBURY

M.C.

The VIBROMIX in industry

So much more than a stirrer...

Here you have, in the Vibromix, a new mixing principle. Instead of revolving blades it has a mixing element vibrating up and down at mains frequency – that is, 6,000 times a minute. The materials are not only circulated but also subjected to considerable impact effect, giving rapid reactions and complete interfacial mixing. As there are no rotating parts, gas can be introduced into the liquid through a hollow shaft. Closed systems, as in the illustration, are very simply arranged by means of a membrane sealing unit.
The volumes given below are an indication of the capacity of the industrial models.

Model E2 (150 watt rating) for 20 to 200 litres.
Model E3 (300 watt rating) for 100 to 800 litres.
Model E4 (1,250 watt rating) for 300 to 5,000 litres.

The model to be used depends on the nature of the materials to be mixed and the volume to be handled. Please ask for questionnaire

SHANDON

SHANDON SCIENTIFIC COMPANY LTD
6 Cromwell Place, London, S.W.7 KNightsbridge 1131.

Stabilag Flask Heaters—unrivalled in durability, service in use and all-round performance. The FIRST choice of really discriminating laboratory chemists.

STABILAG FLASK HEATERS
FOR EFFICIENCY AND SAFETY

Stabilag claim and can prove to have the most efficient heating mantle embodying the highest density load, the most intimate fitting and the strongest heating element with its patented wire laying method of construction.

STANDARD JACKETS *(100 ml—200 litre)*
7½ watts per square inch.
Temperatures up to 450°C.

STANDARD "HIGH-TEM" JACKETS
—for Glass, Quartz and metal vessels.
Standard loading 20 watts per square inch.
Temperatures up to 1,000°C.

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Also available are the Stabilag range of Laboratory Heating Tapes in glass and refrasil—temperatures up to 1,000°C.

THE STABILAG RANGE OF LABORATORY EQUIPMENT IS NOW AVAILABLE FROM MOST MAIN LABORATORY FURNISHERS.

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STANDARD SYNTHETICS

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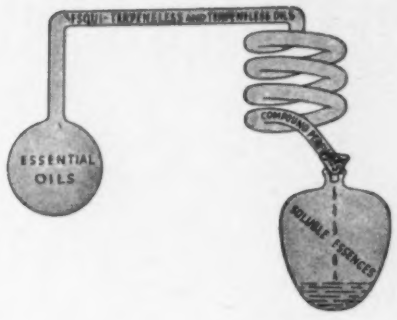

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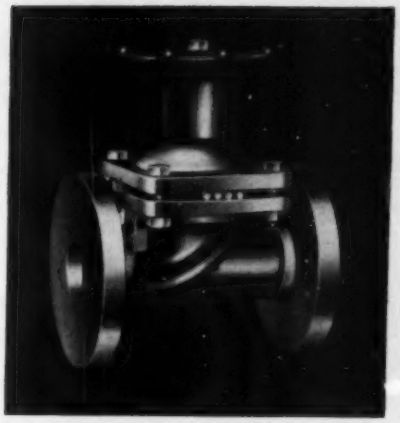

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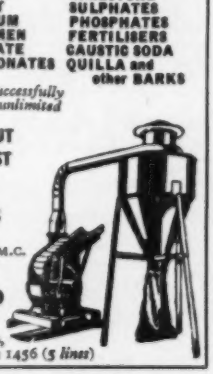

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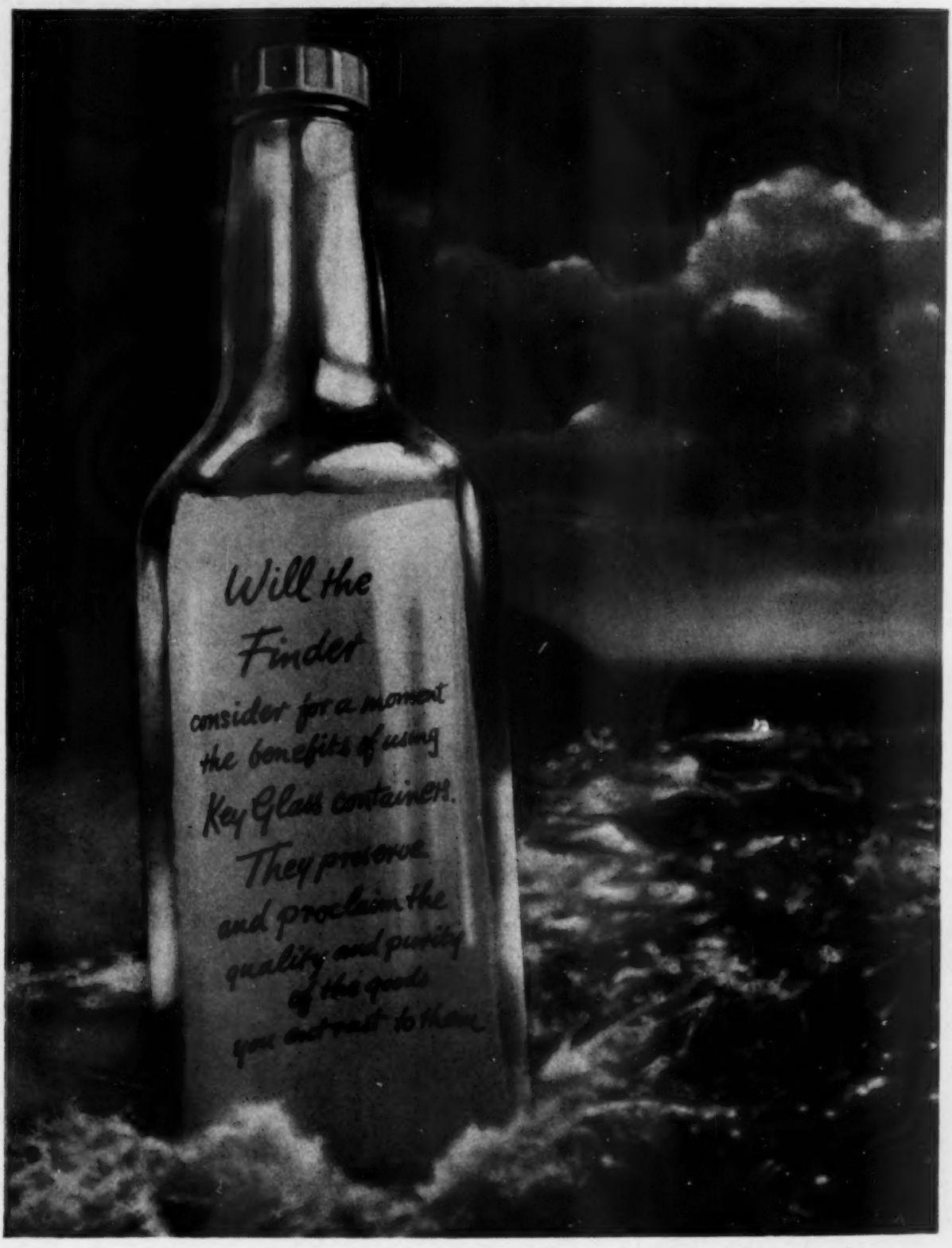

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